RADIO NEWS

SEPTEMBER
1947
35c

How To Build
AN INEXPENSIVE TELEVISION RECEIVER

Page 39

RN-27-J60210-19
JOHN D BRIDGES
5548 14TH AVE
SACRAMENTO 17 CALIF

Accent on MOTION

The famous Model 80 Even Speed Alliance Phonomotor operating on 110 or 220 volts is made for 40, 50 or 60 cycles, 16 watts input, 78 RPM. It has no gears—runs at an even speed—has a smooth, quiet, positive friction-rim drive. Amply proportioned bearings with large oil reservoirs assure long life. A slip-type fan gives cool operation—avoids any possible injury.

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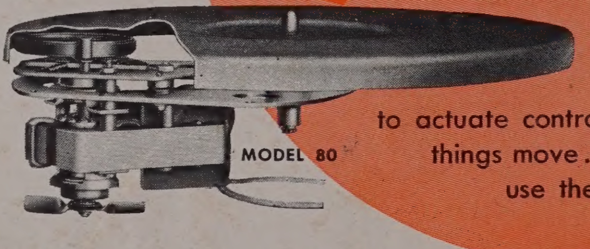

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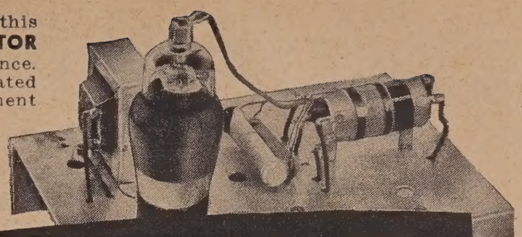

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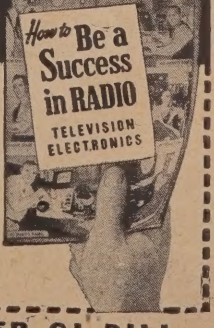

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THE COVER: This home-built television receiver was especially designed for Radio News readers. Building this unit will provide much-needed experience for future television service technicians. Photo by Walter Steinhard.

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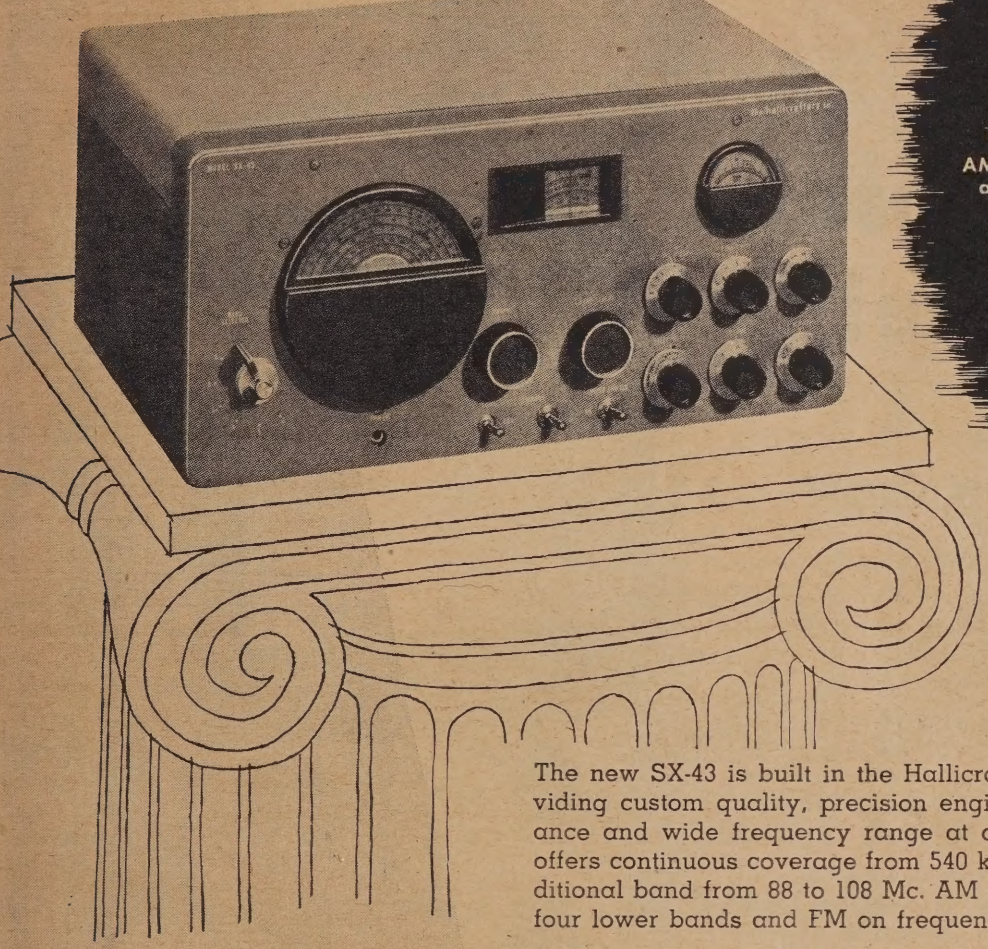

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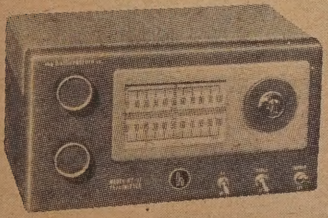

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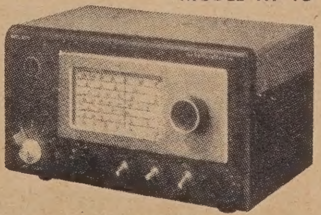

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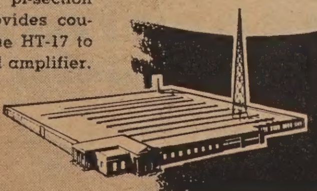

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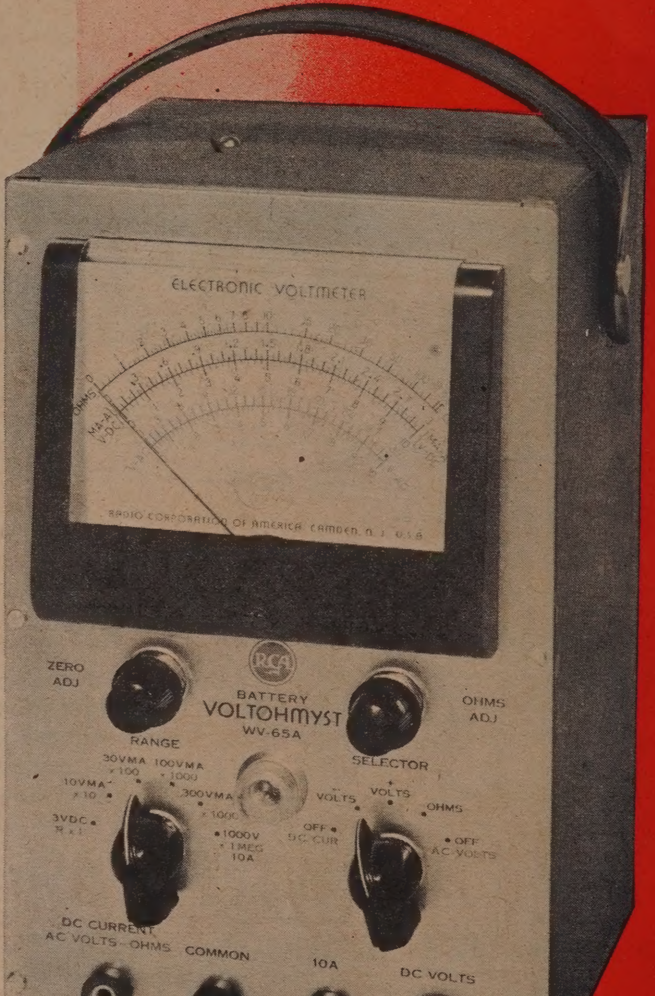

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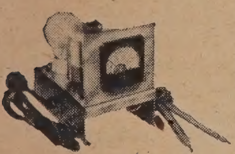

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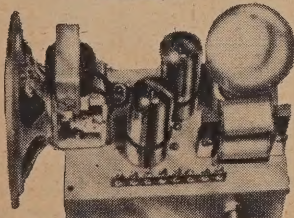

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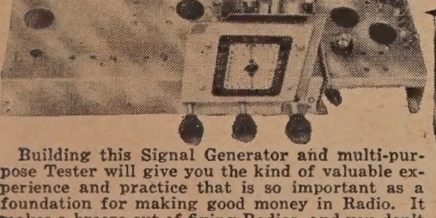

Building this Signal Generator and multi-purpose Tester will give you the kind of valuable experience and practice that is so important as a foundation for making good money in Radio. It makes a breeze out of fixing Radios, and you don't have to spend money on ready-made Equipment.

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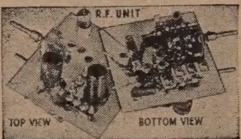

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For the RECORD

BY THE EDITOR

THE editors of RADIO NEWS have long been of the opinion that practical experience with television circuits is required by the thousands of capable and experienced radio service technicians who will soon be called upon to install and service the home television receivers which the radio manufacturers are producing in rapidly increasing volume.

The need for personnel familiar with practical television is increasing daily. In addition to the thousands of experienced technicians in demand by the home market, there is and will be a greater demand for capable technicians in television receiver factories. As industrial television hits its stride, a completely new field of electronic activity will offer splendid opportunities for the television technician and engineer.

In answer to this need for a means of television training, RADIO NEWS takes pride in presenting in this issue a television receiver construction-training project which has been sponsored by the editors. The circuits employed in this receiver are fundamental. The parts and components necessary to build it are, for the most part, standard, of high quality, and not expensive. The circuits are flexible so that the "experimentally minded" service technician can carry on from this unit to explore the many possible variations from the fundamental without undue signal deterioration. Using this fundamental video set, it is possible to later employ a larger picture tube, speaker, etc., at little additional cost.

Because of the complexity of television signals and their associated circuits, it is not practical to attempt to combine theoretical discussions in a construction article of this nature. Therefore, our presentation here presumes that the builder is sufficiently versed in the theory and practical aspects of television receiver design to enable him to complete the project from the comprehensive outline of constructional details contained in the article. We feel that you will be delighted with the results obtained from this initial project.

DUE to the desire of manufacturers to present adequate displays and demonstrations, the RMA has asked that the Radio Servicemen's Convention, previously scheduled to be held in Philadelphia in September 1947, be postponed until January 1948. If the January date is approved, the odds are in favor of a highly successful convention.

AT THIS writing, *Zenith's* Phone Vision system, recently demonstrated in Chicago, hasn't aroused much interest outside of the novelty it afforded passers-by on Michigan Boulevard. Neither *Zenith* nor any telephone company has requested any frequency allocation from the FCC and we seriously doubt that telephone company officials are lying awake nights dreaming up plans for entering the show business.

THE results of our recent field test using narrow-band FM for mobile communications were highly satisfactory. So much so, in fact, that we are now preparing a final version of the RADIO NEWS "Narrow-Band FM Mobile Transmitter." This unit is not much larger in physical size than an ordinary Brownie camera and is light enough to be easily held in one hand.

Experience has shown that the most satisfactory location for a NBFM amateur mobile rig is either in or near the glove compartment.

As a companion unit, we are also building a narrow-band FM receiver which will be approximately the same size as the transmitter.

The interest in FM mobile is definitely on the increase and we feel that the design of compact units will do much to foster further interest in this method of amateur communications.

THERE has recently been an epidemic of "carrier current" broadcast stations put into operation. Most of this activity seems to be centered in southern Indiana. The latest case to be brought to our attention was a station in Columbus, Indiana, signing the call letters LQW and operating on 1150 kc. Programs were made up entirely of recordings and time was sold to the local merchants.

After a short period of operation, the FCC closed down the station for exceeding the maximum allowable field strength and interfering with legitimate broadcast stations. The station was clearly heard on auto radios in several parts of the town.

With the FCC limitations on radiated power, it is practically impossible to operate a station of this type in a legal manner. In the absence of accurate field strength measuring equipment, stay clear of this type of operation and avoid a possible fine and jail sentence. . . . . . O.R.

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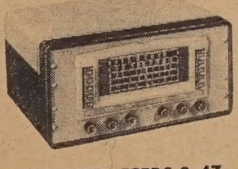
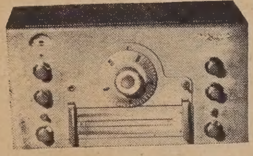


HALLICRAFTERS S-47

New FM-AM receiver. AM reception 535-1720 Kc. and 5.9-18.2 Mc.; FM reception 88-108 Mc. 14 tubes plus rectifier. Bandspread from 9-12 Mc. and 15—18 Mc. Calibrated slide-rule dials; dual tone controls. 500 ohm output. Phono input socket; push-button channel selection; response essentially flat from 30-7500 cps AM; 30-15,000 cps FM. 110 v. AC. 12 watts power output. In cabinet, **NET**. . **$200.00**
Chassis only, **NET** **$189.50**



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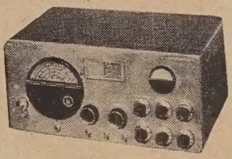

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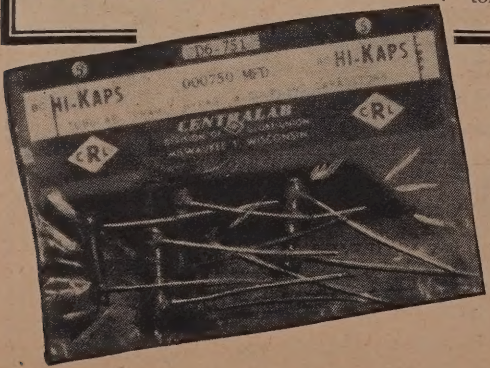

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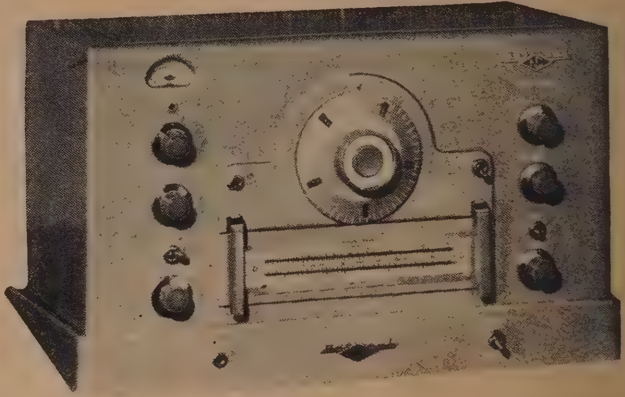

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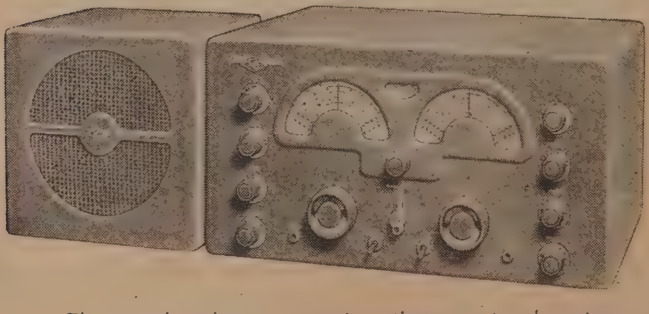

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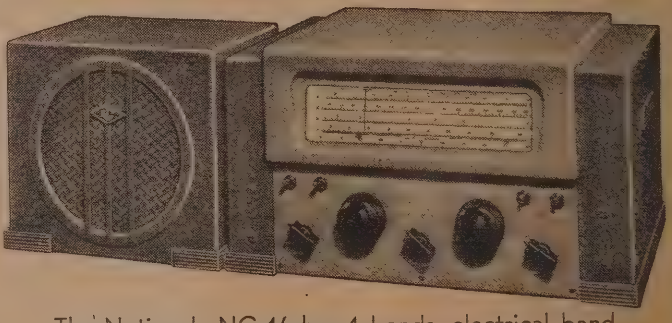

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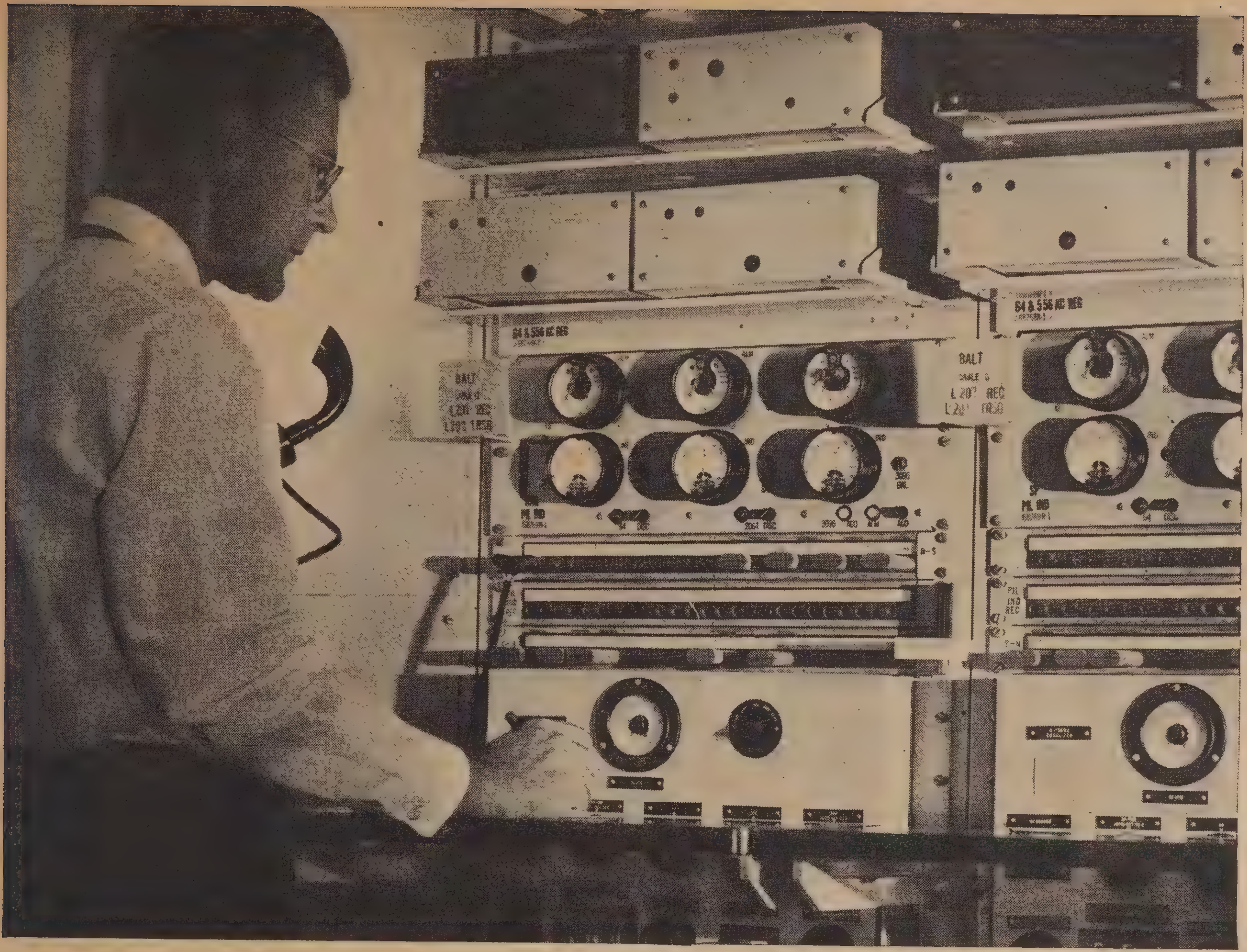

At Philadelphia, a testboard man answers as an electronic watchman calls attention to conditions on one of the coaxial systems to Baltimore and Washington.

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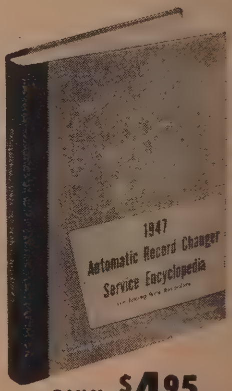

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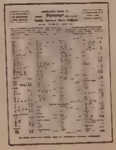

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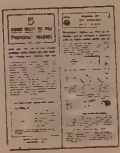

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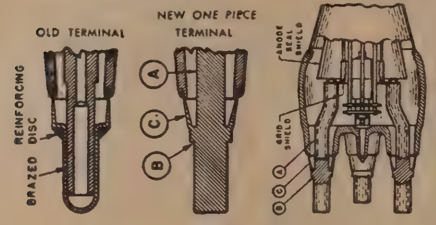

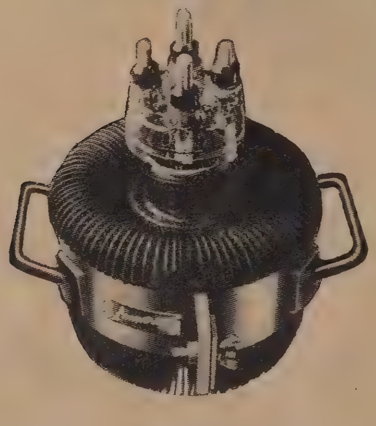

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Spot Radio News

★ ***Presenting latest information on the Radio Industry.***

By **FRED HAMLIN**
Washington Editor, RADIO NEWS

WHATEVER else may be said (and it will be plenty), you can bank on one thing concerning Maine Senator Wallace H. White Junior's bill proposing changes in the Federal Communications Commission; everything including the kitchen sink will be used to beat the proposed legislation to a pulp. After the recent hearings, indeed, the impression was that nobody loves the bill except the Senator from Maine, and it is even possible that he has cast a few dubious (though secret) glances at his brain child following the hornet's nest of protests that it brought swarming round his head. Something else to pin in your hat: While the Senator's proposals caused the loudest explosion in the FCC-broadcasting field, final outcome of the bill will influence all FCC activities, perhaps beneficially. And another thing—despite the Senator's optimistic declarations that he hopes for quick passage, indications, as this goes to press, are that the bill or whatever is hammered out to replace it will remain in radio news headlines for some time to come.

THE BILL IN QUESTION, in case you haven't had the time to go through the volumes of testimony concerning it, proposes that FCC be divided into two sections so that some of its commissioners may concentrate on broadcasting problems while others devote most of their time to other FCC headaches. If the broadcasting experts encounter difficulties fit to blow their heads off, they will be able to seek an aspirin of advice from the other commissioners, and vice versa. But, generally, they will concentrate on their special and assigned fields. So far, so good. But the bill goes on to propose limiting the number of FCC broadcasting franchises economically. If somebody wants to start a station and FCC decides he can't make dough at it, off with his head! Philosophically, in other words, the Senator regards radio not as a vehicle to transport free speech, but as a common carrier, like a bus. Other provisions of the proposed bill carry out this philosophy in some detail.

PROTESTS to the White bill brought out a galaxy of radio talent. Charles Denny, FCC chairman, speaking for the whole Commission, testified that he believed that FCC's work-load should be divided into three, instead of two, compartments, composed of four members each. These would be a Broadcasting Division, a Common Carrier Division, and a Safety and Special Services Division. The chairman would serve on all divisions and in case of a tie the entire Commission would review the moot question. Denny also protested the common carrier idea so far as broadcasting stations are concerned, as well as a number of the details with which Senator White proposed to enforce it. Regardless of his protests, it is worth recording that he and the Senator got along pretty well and both questions and answers were friendly.

NOT SO WHEN THE WITNESSES for the National Association of Broadcasters, led by Justin Miller, NAB president, took the stand. President Miller promptly began to reiterate a theme which he has been expounding for some time. Freedom of radio, he stated, is as sacred as freedom of the press. Any move to hamper that freedom—and the White bill moved against it in a big way—was unconstitutional and a threat to the democracy. Miller, who has never been too sanguine about the present law outlining FCC's powers, said that even it was preferable to the White bill. The Senator promptly came back with charges of "sanctimoniousness," "picayunish quibbling" and "raving and ranting." He even went so far as to say that "all this talk about freedom is talk about something that doesn't exist." Through long sessions, he and his committee and Justin Miller and others from NAM battled angrily. They finally seemed to agree on one thing—that NAB should submit recommendations as to how the bill might be revised. But if Miller's testimony and the White reactions are any indication, such recommendations will only add fuel to the flames.

OUTCOME OF the controversy will probably not, as has been indicated, be as prompt and decisive as Senator White desires. Possibility at writing is that the over-all problem would still be a hot potato when the Congress convenes in 1948. But at least the White bill has already accomplished a couple of things. The NAB-FCC freedom-of-the-air battle at last is in the open. And FCC, regardless of

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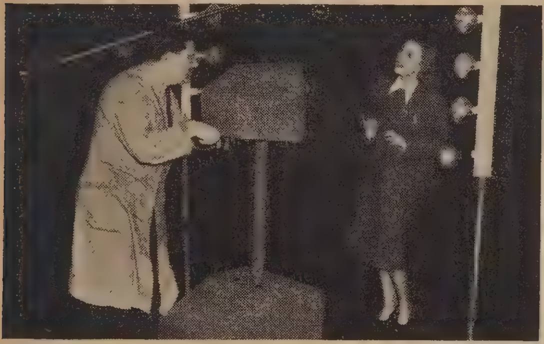

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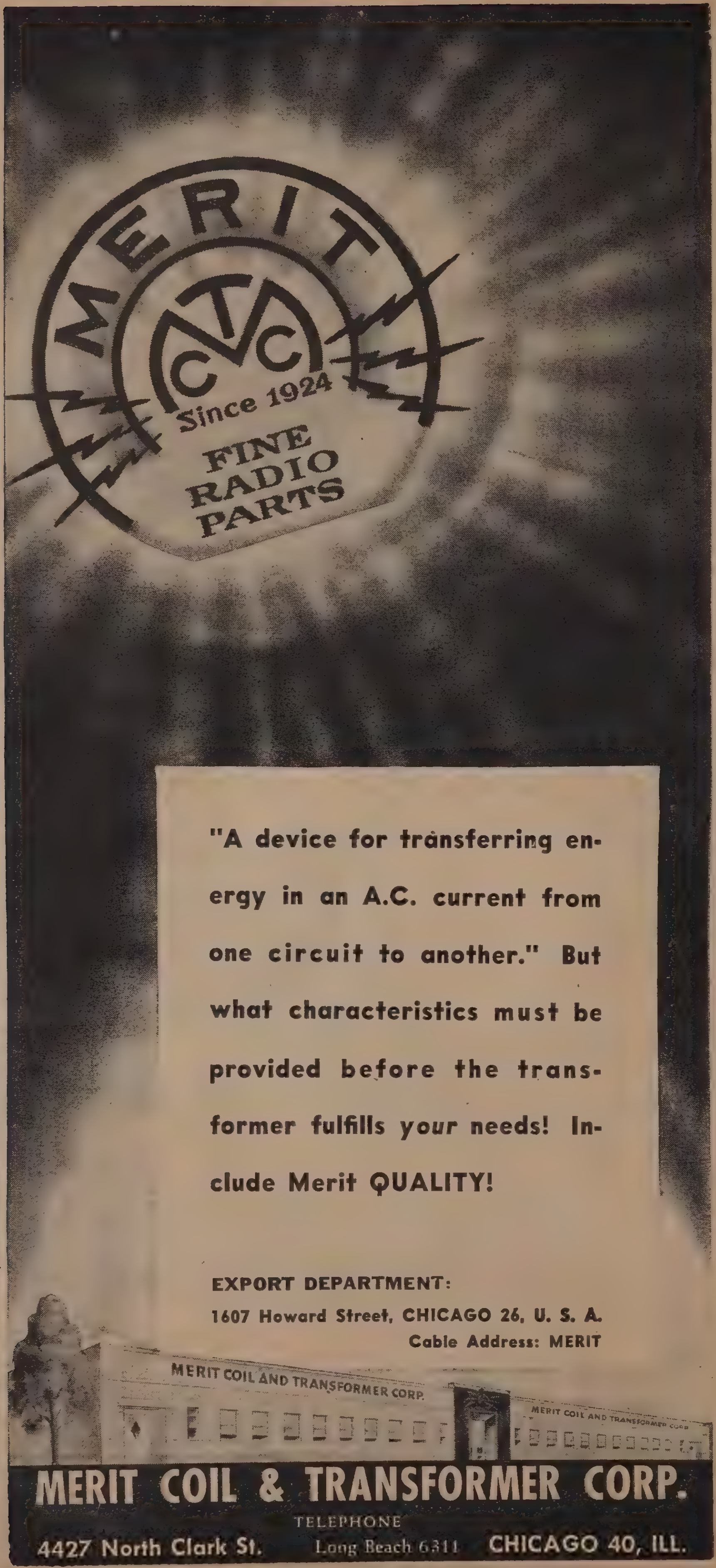
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the White recommendations, will undoubtedly move more rapidly toward reorganization and streamlining. This may even result without legislation, at least to a degree. If the White proposal also eventually results in a "Magna Charta" of radio broadcasting, as some optimists hope, it will be a long time getting rewritten. If the industry is an indication, any resemblance to the present White bill will be purely coincidental.

EVEN FARTHER in the future, if our pipelines do not misinform us, is the pay-as-you-see television idea that President Eugene F. McDonald Jr. of the *Zenith Radio Corp.* proposed during the summer. The McDonald plan would make it possible for television owners to pay only for the program they desire to hear. An owner would call the television operator by phone, order a program, be billed for it by the phone people, and be able to tune it in with the aid of a small attachment on his telephone, which would transmit the missing key frequency to his set. No reaction to the idea could be had from FCC, but it might be in order to point out that the McDonald idea is not unlike one FCC thumbed down some time back. It was proposed to have a "pig-squeal" radio on which you could not get a program without screaming interference unless you paid for it. FCC said no—it would restrict radio's use to persons with extra cash and therefore was not in the best interests of the general public. Another thing that stands in the way of the *Zenith* attachment is that, so far as FCC is concerned, it is still in an experimental stage. It would have to get an experimental permit first, followed by hearings at which, if present trends are an indication, scores of protesters would appear to point out that *Zenith* wanted to use up too much of the spectrum. At best, such hearings would take a lot of time. To climax our little research project on the McDonald idea, we discovered as this went to press that *Zenith* has applied for neither an experimental license or a hearing. That puts them months, if not a year, away from an FCC decision, if any.

THE McDONALD proposal served one purpose—again to highlight television's difficulties in the program department. Programs are costly. A television season pass to a big-league ball park costs around $10,000 and McDonald estimates that a hook-up program comparable to a top-flight AM radio show would cost as much as ten million annually. By contrast, television does not reach mass audiences and advertisers are therefore not willing to spend folding money. It follows that television programs generally have been of poor quality and that there hasn't seemed to be much anybody could do about it. A new departure in the field in Washington recently may point the way to some improvements, however. John Gaunt,

MONEY BACK GUARANTEE We believe units offered for sale by mail order should be sold only on a "Money-Back-If-Not-Satisfied" basis. We carefully check the design calibration and value of all items advertised by us and unhesitatingly offer all merchandise subject to a return for credit or refund. You, the customer, are the sole judge as to value of the item or items you have purchased.

The New KT-30 CHANNEL ANALYZER

The Ultimate in Signal Tracing Includes . . .

METER—For direct reading of signal intensity
SPEAKER—For listening to the signal
PHONE—For checking distortion and listening to the signal in low-gain channels

Comparative signal intensities indicated directly on the meter as Probe follows the signal. A special 4½" P.M. speaker with oversize Alnico V magnet is used for quality checks. Many previously designed Signal Tracers were unable to measure and check low signal intensities. This disadvantage has now been overcome for the Model KT-30 incorporates a special circuit which permits the meter to be put across the output of the Signal Tracer. To accomplish this it is necessary only to flip a front panel switch. This results in additional gain and sensitivity permitting measurement of low signal intensities. An earphone provided with the unit permits listening to the signal in low-gain channels. Incidentally, insertion of the phone automatically cuts out the speaker.

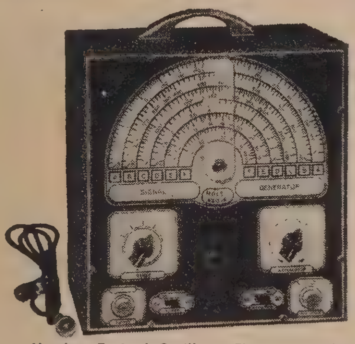
$29.95 NET

Complete with detector probe, test leads, self-contained batteries and earphone. Heavy-gauge crystalline cabinet.

CHANNEL ANALYZER
GENERAL ELECTRONIC DIST. CO.

The New Model 650-A A.C. Operated

SIGNAL GENERATOR

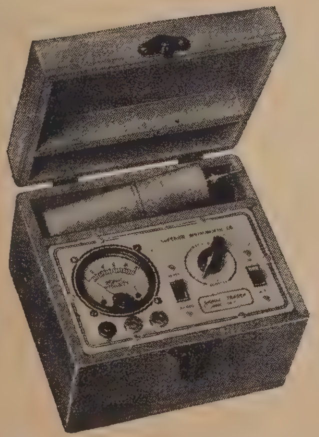


- Operates on 110-120 Volts 50 to 60 Cycles A.C.
- R.F. Frequencies from 100 Kc. to 35 Mc. on Fundamentals in 5 bands by front panel switch manipulation. One additional band provides Harmonics from 30 to 105 Mc.
- Audio Modulating Frequency—400 Cycles Pure Sine Wave. Distortion less than 2%.
- Attenuation: Features a newly designed 3-step ladder type of attenuator (T pad). The first step provides lowest output and can be multiplied by 10 and by 100 by turning the multiplier switch.
- Hartley Excited Oscillator Electron coupled to a Buffer Amplifier. Frequency stability is assured by modulating the amplifier stage.

Complete with coaxial cable, test leads and instructions. Heavy gauge grey crystalline cabinet with beautiful two-tone etched front panel. Size 9½" x 10" x 6."

$39.95 NET

The New Model CA-11 SIGNAL TRACER



SIMPLE TO OPERATE . . . BECAUSE SIGNAL INTENSITY READINGS ARE INDICATED *DIRECTLY ON THE METER!*

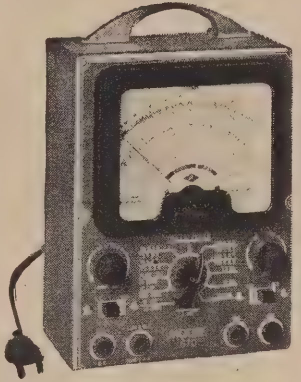
- ★ SIMPLE TO OPERATE — only 1 connecting cable—NO TUNING CONTROLS.
- ★ HIGHLY SENSITIVE — uses an improved Vacuum Tube Voltmeter circuit.
- ★ Tube and resistor-capacity network are built into the Detector Probe.
- ★ COMPLETELY PORTABLE —weighs 5 lbs. and measures 5"x6"x7".
- ★ Comparative Signal Intensity readings are indicated directly on the meter as the Detector Probe is moved to follow the Signal from Antenna to Speaker.
- ★ Provision is made for insertion of phones.

THE MODEL CA-11 COMES HOUSED IN A BEAUTIFUL HAND-RUBBED WOODEN CABINET. COMPLETE WITH PROBE, TEST LEADS AND INSTRUCTIONS.

$18.75 NET

The New Model 670 SUPER METER

A Combination
VOLT-OHM-MILLIAMMETER plus
CAPACITY REACTANCE,
INDUCTANCE and
DECIBEL MEASUREMENTS



D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500. A.C. VOLTS: 0 to 15/30/150/300/1500/3000 Volts. OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000. D.C. CURRENT: 0 to 1.5/15/150 Ma.; 0 to 1.5 Amps. RESISTANCE: 0 to 500/100,000 ohms, 0 to 10 Megohms. CAPACITY: .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics). REACTANCE: 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms. INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries. DECIBELS: −10 to +18, +10 to +38, +30 to +58.

THE MODEL 670 COMES HOUSED IN A RUGGED, CRACKLE-FINISHED STEEL CABINET COMPLETE WITH TEST LEADS AND OPERATING INSTRUCTIONS. SIZE 5½" x 7½" x 3".

$28.40 NET

The New Model 450 TUBE TESTER

Speedy operation—assured by the newly designed rotary selector switch which replaces the usual snap, toggle, or lever action switches.

SPECIFICATIONS

- Tests all tubes up to 117 volts.
- Tests shorts and leakages up to 3 Megohms in all tubes.
- Tests both plates in rectifiers.
- New type line voltage adjuster.
- Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes
- Noise Test detects microphonic tubes or noise due to faulty elements and loose internal connections.
- Uses a 4½" square rugged meter.
- Works on 90 to 125 volts 60 cycles A.C.

EXTRA SERVICE—May be used as an extremely sensitive condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

$39.50 NET

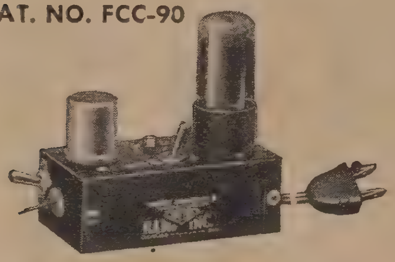
GENERAL ELECTRONIC DISTRIBUTING CO.

Dept. RN-9, 98 Park Place
NEW YORK 7, N. Y.

NEW
BUD
self-powered

FREQUENCY CALIBRATOR

CAT. NO. FCC-90



Measures only 2¼" by 4¼"

● Now you never have to take the chance of getting a pink ticket for off-frequency operation . . . BUD makes it easy for you to know your exact frequency. The new BUD Frequency Calibrator is easy to use, is entirely self-powered and has these exclusive features:

It is not necessary to open up or take apart your receiver to wire-in this unit . . . just plug in to 110 volt line and connect output lead to antenna post of your receiver.

Has 100 Kilocycle crystal, rich in harmonics.

Has compensating condenser to zero beat WWV.

Has usable harmonics up to 30 megacycles.

Has ON-OFF switch, and STANDBY switch.

Complete with tube and crystal . . . Dealer net only.............. $14.25

See it at your distributor's today.
Install one in your RIG TONIGHT!

BUD CAN SUPPLY ALL YOUR NEEDS!

. . . with the latest types of equipment including: condensers—chokes—coils—insulators—plugs—jacks—switches—dials—test leads—jewel lights and a complete line of ultra-modern cabinets and chassis.

BUD
BUD RADIO, INC.
CLEVELAND 3, OHIO

WNBW television producer, took a two-hour-fifteen-minute play, "All Gaul Is Divided," by John McGiver, edited it to an hour's program, enlisted the help of Catholic University's dramatic department, trained the CU cast in television techniques, and came up with a history-making program. Frankly an experiment, it won friends for television and, although involving hard work for everybody concerned, cost very little. Gaunt is also working on dramatization of the stories behind paintings in Washington's National Gallery. At the same time, he is not pessimistic about the television futures in sports events, especially baseball and boxing.

NEARER TO actual use by the public on a widespread basis are facsimile transmissions, which the FCC recently announced "may soon become a regular broadcast service." Only thing that's holding things up are rules and standards for the service, and they should be forthcoming soon. Close cooperation by manufacturers, broadcasters, and newspaper publishers brought about the rapid development of the service. On the basis of experimental work in the field, FCC reports that transmission of pictures and printed matter will become rapidly commonplace, with scores of other applications in the offing. For instance, facsimile news service for airplane passengers in flight has proved feasible. The radioed press dispatches were printed on an airliner in four columns at the rate of 500 words a minute. Operations by a New York bank were sped up through rapid transmission of check reproductions from the bank's downtown central signature file to its uptown headquarters. Transmissions were completed in less than a minute. Microwave transmission has been used successfully to relay facsimile from Boston to New York, and the Army Air Forces are planning to use it on a national hook-up for transmitting weather maps. There is even work under way toward using facsimile on the telephone. Seems you can call the girl-friend and if nobody answers can leave a facsimile note asking her where she's been.

ALSO ON THE FRONT of the FCC stove is the long-heralded "Citizens Radio Service," in the band of 460-470 megacycles. Manufacturers are already working on pocket-sized sets in this field. All that remains is for them to get into mass production and for FCC to draw up rules and regulations. Tests indicate that the new gadgets will break down about any last barrier that may remain to radio. In FCC's words, "The possibilities for utilizing this type of radio are unlimited." If the girl-friend is in danger of a facsimile note checking up on her doings, the boy-friend is threatened with a direct hook-up with home, regardless of what lengths he has gone to get away from it all. Private boats and vehicles will be able to use it, possibly even connecting with telephone systems. The boss will be able to break into your fishing activities and your wife will be able to hook you up while you are on a hunting trip. . . . One the credit side of the ledger, widespread use is expected for disasters, ranching, mining, and exploring. How soon the sets will be in your hands is mostly a postwar production problem. Next summer will be the earliest. But once they are available, FCC predicts that licensing will be easy—"a simple procedure requiring no technical knowledge by the prospective user."

ALTHOUGH SET OUTPUT showed signs of tapering off from the spring peaks, reports from all along the line indicate that the industry is going to have one of the best years in its history. Set-production drop came in May, but was still in the box-car figure stage—1,316,373 as compared to April's estimated total of 1,548,540. The figures are based on reports from members of the Radio Manufacturers Association. RMA also reported that May saw television production up to 8690 as compared with 7886 for April's five weeks. FM-AM receiver production continued good—84,507. Drop in the total set production was regarded as partly seasonal, and no cause for alarm. Monthly production up to May indicated an annual total of 18,000,000, whereas estimates for a prosperous year early in the spring were for 15,000,000.

APPARENTLY IN STEP with the production pace is employment, up 18 per-cent this year in the broadcasting field as compared to the fall of 1945, according to the latest FCC figures. Seven networks and 924 standard broadcast stations employed 34,831 persons in the first week of February this year, 18 per-cent above the October, 1945 figure of 29,405. The 1947 total included 30,100 full-time staff employes and 4731 non-staff program workers. Salaries are also up. Excluding executives, supervisors and non-staffers, the 1947 broadcast employe got an average of about $61.00 a week, as contrasted with the 1945 figure of $58.00.

ALSO IN THE BOXCAR figure class are anticipated U.S. radio exports this year as estimated by George R. Donnelly of the Department of Commerce. Donnelly figures that the total will go to more than $60,000,000. This is well ahead of the all-time record radio export year—1944—when the total was $44,781,289. "Despite many obstacles to trade, radio receiving equipment and components are still being widely distributed abroad," says Mr. Donnelly, who predicts that in 1947 they will "undoubtedly greatly exceed those for 1946." The '46 figure was

(*Continued on page* 185)

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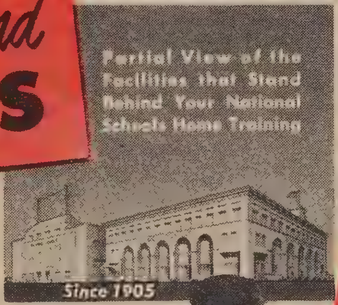

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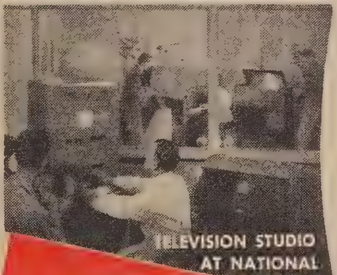

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We Bring NATIONAL SCHOOLS to You

A PRACTICAL RESIDENT TRADE SCHOOL

With Its Own Shops and Laboratories

FOR OVER 40 YEARS

TODAY, OPPORTUNITIES IN THE RADIO, ELECTRONICS AND TELEVISION INDUSTRY ARE TAKEN FOR GRANTED

We see them everywhere: The Home Radio Service Field continues to grow. **Television is here** . . . Television Broadcasting facilities are being rapidly expanded. Television sales, service, installation and maintenance requirements are more and more important from day to day. **Electronics is an important factor** in many applications for utility, safety, accuracy and convenience. **Airlines** are finding new uses for Radio bringing new benefits to air transportation. **Ships at sea** are employing Radar together with other conventional Radio apparatus for ship-to-shore communications and safety. **Frequency Modulation** is modernizing Radio Broadcasting, offering static-and-interference-free reception in the home. **The list of Radio applications is almost endless,** and every one represents increasing opportunities in our modern world for the **RADIO, TELEVISION AND ELECTRONICS TECHNICIAN WITH A SOLID TECHNICAL BACKGROUND.**

NOT JUST ANY TRAINING WILL DO

It is not a question of opportunity but rather how to take advantage of existing opportunity. Only proper training can make these opportunities a **reality.** National Schools of Los Angeles, one of the oldest and largest technical trade schools in the United States, **offers you Shop Method Home Training, a proved method that builds qualified technicians.** Here is Home Training that BRINGS RESULTS.

Behind **all** training from National Schools stands a permanent faculty of experienced instructors and engineers. These men are daily teaching resident students right in our own Shops and Laboratories. From first hand experience with students here at school, our instructors understand the needs and ambitions of men like you. All of our instructors, both Home Study and Resident, have ideal facilities to make your training practical, up-to-the-minute, interesting. It takes years of experience to know how to train men, especially in the practical technical trades. Established almost 50 years ago, National Schools has a rich background of experience to help you to take full advantage of the opportunities in the Radio, Television and Electronics Industry

HERE'S JUST A FEW OF THE INTERESTING FACTS YOU LEARN WITH THE FREE MANUAL

1. Routine for Diagnosing Radio Troubles.
2. Preliminary Inspection of Receivers.
3. How to Check Power Supply.
4. How to Identify Various Stages of Receivers.
5. How to Trace the Circuit and Prepare Skeleton Diagram.
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8. How to Test Detector, I.F., R.F., and Mixer Stages.
9. Complete Reference Table for Quickly Locating Receiver Troubles.

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During the war, National trained enlisted men under contract with the War Department. Both the Armed Forces Institute and Marine Corps Institute used our lesson texts on a wide scale. Now, we are training veterans, both resident and home study, through the Veterans Administration. If you are a veteran of World War II—and qualified for training under the G.I. Bill of Rights, check the coupon for special information.

TELEVISION ELECTRONICS
RADIO SHOP MANUAL

GET THESE 2 BIG BOOKS FREE!

Begin Training at Home Later Come to Our Shops and Laboratories in Los Angeles —*If You Prefer*

National's Master Shop Method Home Training in Radio, Electronics and Television is COMPLETE in itself. No other training is necessary; but, some men do prefer to take a short experience course here in our resident shops and laboratories, at the end of their Home Study training. They find it helpful to spend a short period of time in our modern Broadcasting Station, or our New Television Laboratories and Studios, or our Extensive Radio Servicing Shops—as well as other departments covering every specialized phase of the Radio Industry.

You are welcome to take advantage of this additional instruction if you wish. If you are interested, check the coupon below. Full details will be sent you by return mail. National Schools' OUTSTANDING FACILITIES MAKE IT POSSIBLE TO OFFER THE FINEST POSSIBLE TECHNICAL TRADE TRAINING IN RADIO, TELEVISION AND ELECTRONICS.

You Get All This Radio Experimental Equipment to Use and Keep at Home!

LEARN BY DOING is the basic principle of National's Shop Method Home Training. We send you standard Radio parts for an interesting series of experiments which demonstrate the fundamentals of Radio, Television and Electronics. The very essence of this training is EXPERIENCE—you get actual experience by building many different types of circuits. You build a fine, long distance MODERN SUPERHETERODYNE RECEIVER, signal generator, low-power Radio transmitter, audio oscillator, etc. This **practical work** develops your knowledge of Radio step by step, makes you a **practical** Radio Technician.

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Mail me FREE the two books mentioned in your ad, including a sample lesson of your course. I understand no salesman will call on me. I have checked below the plan which interests me.

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☐ In am interested in home study only.
☐ Send information on your Combined Home-Study and Modern Resident Shop Training.
☐ Veteran of World War II.

$175 AND 25 MONOSETS GIVEN

To Winners of This

EASY CONTEST!

RADIO AMATEURS

Just write 50 words or less telling us why you like the TELEX MONOSET *better than old style earphones.*

WIN:

$100 and a Monoset

$50 and a Monoset

$25 and a Monoset

PLUS TELEX MONOSETS to 22 Runner-ups!

HERE'S ALL YOU DO:

1. Go to your *parts jobber* and ask him to let you try out the revolutionary under-the-chin TELEX MONOSET.

2. In 5 minutes you'll get at least half a dozen good, WINNING ideas. Be sure to get *all* the facts and an OFFICIAL ENTRY BLANK.

3. Then write 50 words or less telling us "Why the TELEX MONOSET is Better than Old-Style Earphones." Clearness and sincerity will count most.

4. Print or type your answer on the OFFICIAL ENTRY BLANK your jobber will give you.

Mail direct to: TELEX, INC., Telex Park, Minneapolis 1, Minnesota, before Midnight October 15, 1947.

FIRST PRIZE: $100.00 cash and a TELEX MONOSET
SECOND PRIZE: $ 50.00 cash and a TELEX MONOSET
THIRD PRIZE: $ 25.00 cash and a TELEX MONOSET

TELEX MONOSETS to the 22 next best opinions. In case of a tie, *duplicate* prizes will be awarded.

Employees of Telex, Inc. and their advertising agency not eligible to enter this contest.

NO BOX TOPS!
NO JINGLES!
Get Entry Blank From Your Parts Jobber

CONTEST CLOSES MIDNIGHT OCTOBER 15, 1947!

TIPS TO GET STARTED WITH:

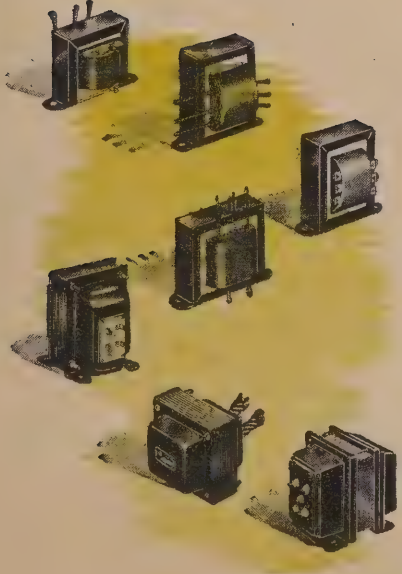
1. TELEX MONOSET is quickly replacing old-style, cumbersome headsets because you wear it under-the-chin instead of over-the-head.
2. Featherweight: Only 1.2 oz. No ear fatigue.
3. Excellent fidelity. Clear, natural reception of sound.
4. Reliable performance assured by TELEX precision engineering.
5. Exclusive, TELEX designed, volume control—permits individual adjustment of volume.

HEARING AT ITS BEST
TELEX
TELEX INC.
ELECTRO-ACOUSTIC DIVISION
TELEX PARK
Minneapolis, Minn.

Decision of impartial judges will be final. All entries become property of Telex, Inc. Winners will be notified by mail approximately November 1, 1947. Contest subject to all state and federal regulations.

Remember, wherever a headset is used—TELEX MONOSET will do the job better.

BRANDED and PACKAGED for your protection



Satisfied customers' goodwill is your surest formula for building a successful service business . . . However—the finest craftsmanship of the serviceman's art is to little avail if not protected against installations of inferior merchandise.

Genuine STANCOR transformers, "first" in the field, is your customer-assurance of the finest, top-quality units . . . and when you use STANCOR you are installing genuine "PROTECTED PRODUCTS," for STANCOR transformers, packed with complete installation instructions, come to you *permanently stamped for guaranteed protection, and expertly packed for your fast identification* . . . Guarantee customer goodwill through STANCOR.

standardize on **STANCOR** STANCOR **TRANSFORMERS**

STANDARD TRANSFORMER CORPORATION • ELSTON, KEDZIE AND ADDISON • CHICAGO 18, ILL.

How Much Competition Have ***You***

... For Your Present Job — For a Better Job?

Again employers can afford to be "selective", particularly with thousands of new, ambitious, young men who have entered the radio industry since the war. This means you must improve your technical knowledge not only to qualify for the better job you want, but to *hold* the job you now occupy.

Your own success in radio depends upon the effort you make *now* to fortify yourself with modern technical training. You may have "gotten by" up to this point. But, if you are like some radiomen, many wartime and postwar technical advances of the industry have passed you by. Developments of the past few years call for an entirely new understanding and knowledge of technical radio practice. If you want to progress with the industry . . . if you want an important, good-paying position and the future security that goes with it — you must acquire up-to-date technical training.

We invite you to investigate the CREI proved program for professional self-improvement for which thousands of professional radiomen have enrolled since 1927. CREI can help you by providing down-to-earth, practical technical training that should equip you to advance to the better-paying radio jobs that offer security and happiness. CREI home study courses in Practical Radio-Electronics Engineering can equip you to step ahead of competition.

The facts about CREI and what it can do for you are interestingly described in our 24-page booklet. It is well worth your reading. Send for it today.

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If you have had professional or amateur radio experience and want to make more money, let us prove to you we have the training you need to qualify for a better radio job. To help us intelligently answer your inquiry — IN WRITING PLEASE STATE BRIEFLY YOUR BACKGROUND OF EXPERIENCE, EDUCATION and PRESENT POSITION.

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Gentlemen: Please send me your free booklet, "CREI Training for Your Better Job in RADIO-ELECTRONICS", together with full details of your home study training. I am attaching a brief resume of my experience, education and present position.

Check ☐ PRACTICAL RADIO ENGINEERING
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NAME..
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CITY..............................ZONE..........STATE..............
☐ I am entitled to training under the "G.I." Bill.

6 On Raft
Drift
Across Pacific

Courtesy of Science Illustrated

KON-TIKI EXPEDITION PICKS NATIONAL RECEIVERS

National NC EST 1914

Somewhere in the vast loneliness of the Pacific a frail balsa wood raft is drifting westward, carrying six Norwegian scientists toward the Polynesian Islands. Their mission: to prove that the Polynesians could have been settled by prehistoric Peruvian Indians.

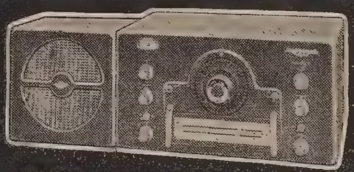
Courage, yes, recklessness, no. These adventurers are scientists, not stunt men. Before setting out from Peru they made sure that they would have the finest radio equipment in the world . . . National receivers, of course (Models NC-173 and HRO-7).

For safety . . . to bring in the weakest signal in the worst kind of weather . . . *for science* . . . to exchange vital weather and navigational data with land stations thousands of miles away. Battered by wind and sea for months on end these superb National receivers aboard the Kon-Tiki Expedition raft are still functioning as reliably as ever.

What better testimonial than operator Knut Haugland's cheerful "All's Well" radioed from the Tuamotu Archipelago . . . 4000 miles across the Pacific, and still going strong.

Congratulations are also in order to W6AOA, W6EVM, and W3YA who have been in regular contact with LI2B. 27.98 and 14.142 megs have been assigned for general contact. Next time you go on the air, why not see if you can contact Haugland and get the Expedition's story first-hand.

National Receivers of the Type Selected for the Kon-Tiki Expedition



HRO-7

Brand-new successor to the famous HRO used throughout the world, 11 tubes plus a voltage regulator. . . . Frequency coverage from 50 to 430 and 480 to 30,000 kc. . . . Adjustable Threshold Noise Limiter. . . Streamlined grey cabinet. AM phone and code reception.

NC-173

A new and versatile receiver, popularly priced. Frequency coverage from 540 kc to 31 mc plus the 48-56 mc range. Calibrated amateur band spread on 6, 10-11, 20, 40 and 80 meter bands. Phonograph or Microphone pick-up jack.

National Company, Inc.
Malden, Mass.

MAKERS OF LIFETIME RADIO EQUIPMENT

Listen ...IT'S A Jensen

MODEL VH-91
Hypex* SPEECHMASTER

Delivering good quality, intelligible speech with maximum "punch" to override high noise levels, the Model VH-91 Speechmaster is recommended for paging and intercommunication applications. Hypex horn formula gives useful output over a 100° angle.

Especially efficient for voice, the VH-91 has a frequency range of 400-5,000 cycles. Power handling capacity: 15 watts maximum speech signal input. Designed for both inside and out-of-door use, VH-91 will withstand extreme weather conditions, including exposure to salt spray. Nominal voice coil impedance 8 ohms. Transformer number Z-3345, with ⅝" x ⅝" core available for 45-ohm use. Bell diameter, 8⅞ inches; height, 9-1/16 inches; weight, 4¼ pounds.

Universal mounting bracket adjusts projector to any direction, locks securely in position by a single wing nut, has facilities for mounting transformer.

Jensen VH-91 Speechmaster Projector (ST-171)............$32.50

*Trade mark registered

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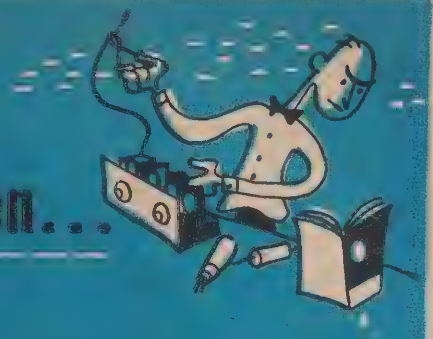
Designers and Manufacturers of Fine Acoustic Equipment

FREE to servicemen...



the Capacitor
CORNELL-DUBILIER
CD
Vol. 12
MAY 1947
CORNELL DUBILIER ELECTRIC CORP.
Hamilton Boulevard, South Plainfield, N. J.
POSTMASTER: If undeliverable for any reason, notify stating reason, on form 3547, postage for which is guaranteed

the magazine that makes your service jobs easier — faster — more profitable

tells you what to do — how to do it — chock full of FM and television servicing information — simplifies complicated jobs — tested ways of boosting shop traffic

Here's a magazine which can go a long way toward making your shop *the* radio shop in your community. Every month it is *loaded* with ideas — not impractical, day-dreamy schemes which look good only until you try using them — but down-to-earth, tested plans which have actually been used with success by other servicemen just like yourself.

Its convenient, pocket-size pages contain valuable technical data — latest dope on new type tubes — notes on trouble shooting — yes, and dozens of helpful hints which will help you to repair any radio ever made easier, better and twice as fast.

Accept "The Capacitor"—every month—with C-D's compliments. Put it to work in your shop speeding up repair jobs — building bigger profits. *Don't wait! Mail coupon below NOW so your FREE subscription will start at once.*

Read what these successful service men say about "the Capacitor"

FROM MAINE: *"Your magazine carries much of interest to the serviceman. Keep up the good work."*

• • • • •

FROM MISSISSIPPI: *"The C-D Capacitor is a fine paper. My apprentice uses it to good advantage."*

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FROM ILLINOIS: *"I think the C-D Capacitor is one of the finest and most complete publications I have ever had the pleasure of receiving."*

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FROM KANSAS: *"Ads in The Capacitor saved me over one hundred dollars on test equipment. A great magazine."*

FREE ADVERTISING FOR SERVICEMEN

Looking for a new signal generator? Want to sell that spare 'scope? Interested in swapping some equipment with other servicemen? *The Trading Post* — which appears every month in "The Capacitor" will carry your ad FREE. Cornell-Dubilier Electric Corporation, Dp. RN-9, South Plainfield, N. J.

Mail This Coupon TODAY

CORNELL-DUBILIER ELECTRIC CORPORATION, Dept. RN-9
South Plainfield, New Jersey

Please enter my name to start receiving "The Capacitor" at once — absolutely free.

Name..

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City.......................................Zone.........State.........................

☐ *I own my own shop.* ☐ *I am employed. (Please check one)*

1910 1947

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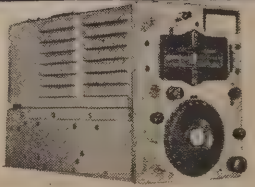
WORLD'S LARGEST MANUFACTURER OF

CAPACITORS

MICA — DYKANOL — PAPER — ELECTROLYTIC

If it's Radio... HARVEY has it!



BC 459A VARIABLE FREQUENCY TRANSMITTER

Frequency range 7 — 9.1 MC. Uses 1626 variable oscillator and parallel 1625's in amplifier. May be used as VFO for all bands from 1¼ thru 40 meters with appropriate doublers. Has self contained G.E. hermetically sealed 8 mc crystal oscillator and tuning eye which is used as a check point for dial calibration. Complete with tubes and crystal. Special price $9.95

SCR 522 — *Receiver and transmitter only.* In perfect condition. Complete with all tubes, less generator and control box. Get your order in quickly, supply limited. Special price $14.75

1616 TUBE

Half wave, high vacuum rectifier. Filament 2.5 volts, 5 amps; peak inverse 5500 volts; peak current .8 amps; surge current 2.5 amps; average plate current .130 amps. List price $7.50, Harvey special price, while they last..........95¢

HARVEY HAS IN STOCK THE NEW NATIONAL HRO-7 RECEIVER

This new HRO-7 features many new refinements in receiver circuitry and design. A new automatic adjustable threshold coupler, active noise limiter effectively reduces interference by external noise pulses. Two new metal type tubes — a 6C4 high frequency oscillator and OA-2 voltage regulator are employed to give a high order of oscillator stability, thereby assuring a minimum of tuning drift.

The HRO-7 is housed in a new completely restyled cabinet with an attractive gray finish. Coils furnished cover 1700 to 30,000 KC. The receiver, complete with coils and power supply but less speaker, is priced at $299.36

GET YOUR ORDER IN EARLY FOR IMMEDIATE DELIVERY

NOTE: All prices quoted are NET, FOB New York and subject to change without notice.

Telephone: LOngacre 3-1800

hrc HARVEY RADIO COMPANY INC.

103 West 43rd St., New York 18, N. Y.

Within the INDUSTRY

BURLINGTON INSTRUMENT COMPANY of Burlington, Iowa, has recently appointed three new representatives to handle the company's line of electrical indicating instruments, generator voltage regulators, automatic synchronizers, and other electrical control equipment.

Ernest G. Hendrickson of Spokane, Washington will handle the states of Montana, Idaho, and part of Washington. Forrest C. Valentine of Fort Wayne, Indiana will cover Indiana, Kentucky, and part of Ohio, while *White Sales Company* of Boston, Massachusetts will serve customers in the states of Connecticut and Rhode Island.

* * *

ROBERT W. GUNDERSON, W2JIO, has joined the *Newark Electric Company's* New York staff where he will advise amateurs on their equipment problems.

In addition to his activities as a consulting radio and electronic engineer, Mr. Gunderson is a principal in the new *Minitron Corporation,* specializing in the manufacture of miniature radio and electronic equipment.

Mr. Gunderson devotes his evenings to teaching radio to blind students at the New York Institute for the Blind. He was instrumental in obtaining an amateur license for the only totally blind and deaf ham on the air today.

* * *

CLARK C. RODIMON, well-known radio amateur, has joined the staff of *National Company, Inc.* of Malden, Massachusetts.

Mr. Rodimon will concentrate on the study, development, and marketing of products sold in the amateur and commercial markets.

He has been associated with the *American Radio Relay League* staff since 1926. He served as Editor of "QST" for over ten years. During the war years, he was granted a leave of absence from "QST" to direct *Raytheon's* Field Engineering programs. He also assisted in government contact service and commercial radar sales.

* * *

CORNELL-DUBILIER ELECTRIC CORPORATION'S Power Factor Division has practically doubled its manufacturing capacity with the completion of an additional plant of 41,000 square feet area.

The expansion of this division included complete mechanization of the department, extension of a siding into the plant, and a special conveyor system for transporting heavier loads to and from flat cars.

* * *

LESTER L. KELSEY has resigned as Vice-President of *The Hallicrafters Co.* of Chicago to accept the position of Vice-President and General Sales Manager of *The Dayton Acme Company* and two of its subsidiaries, the *Osborne Register Company* and the *M. L. Andrews Company,* all of Cincinnati, Ohio.

Mr. Kelsey was associated with *Grigsby-Grunow* and with *Stewart-Warner* as General Sales Manager of the radio division for eleven years before joining *The Hallicrafters Co.*.

In his new position Mr. Kelsey will be in charge of sales for the complete line of *Osborne* National Food Machines, *Osborne* National Cash Registers, and other company products.

* * *

A. AUSTIN ELLMORE has been named Sales Manager and Chief Engineer for *Crescent Industries Incorporated.*

A graduate of DePaul University and a member of the teaching staff of Northwestern University from 1923 to 1927, Mr. Ellmore was formerly associated with *Utah Radio* as Vice-President in charge of Sales and Engineering, a position which he held for the past 18 years.

In addition, Mr. Ellmore is active on seven RMA committees and serves as Chairman of the Committee on Speakers and the Committee on Acoustic Devices.

* * *

NICOLAS ANTON, Vice-President in Charge of Manufacturing, was elected President of *Amperex Electronic Corporation* of Brooklyn.

Dr. A. Senauke, the retiring President, has become Chairman of the Board of Directors.

* * *

WILLIAM McMILLAN ADAMS has been added to the executive staff of *Sprague Electric Company* to handle export activities of the organization.

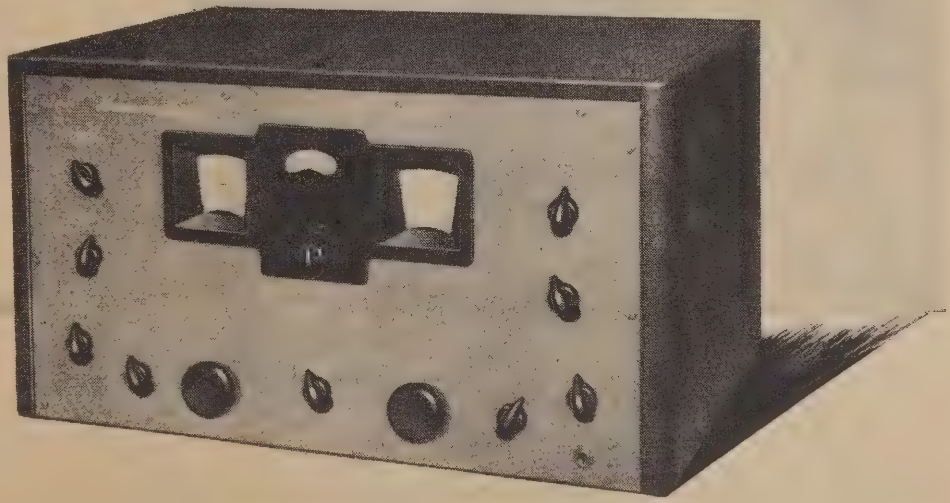
Well-known in business circles, Mr. Adams was formerly associated with the *United States Rubber Company.* He also served as President of the *New York Triplex Safety Glass Company* and was a Managing Director of *Fortnum & Mason, Inc.* of New York.

Mr. Adams, who is a veteran of both World Wars, was educated at Eton College and Cambridge University

HIGH SCORER

HQ-129-X

In any contest, Sweepstakes or DX, you will find HQ owners way up among the High Scorers. Why? Because the HQ-129-X has what it takes—plenty of selectivity to dig out those "down under" stations that you have to work if you want to be **HIGH SCORER.**



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HAMMARLUND

THE HAMMARLUND MFG. CO., INC., 460 W. 34TH ST., NEW YORK 1, N.Y.

MANUFACTURERS OF PRECISION COMMUNICATIONS EQUIPMENT

Lick any Radio Repair Job

...IN LESS TIME...

WITH LESS WORK!

Make More Money in Servicing!

Alfred A. Ghirardi

GOODBYE TO TEDIOUS TESTING

Contains repair data on

Admiral G-E
Airline Majestic
Arvin Philco
Belmont RCA
Capehart Silvertone
Crosley St.-Warner
Emerson Strom.-Carl.

. . . and 198 other makes!

Four radio repair jobs out of every 5 can be handled as easy as falling off a log! Problems that might puzzle you and call for hours of tedious testing can be solved in an instant! Just look up the make and model of the set to be repaired in the Trouble Case History section of Ghirardi's famous RADIO TROUBLESHOOTER'S HANDBOOK. Then go to work! Clear, easily understood instructions tell you exactly what the trouble is likely to be—exactly how to fix it. No lost time or motion. Work twice as fast. Make twice as much money!

SERVICE DATA ON ALMOST EVERY RADIO USED TODAY!

The 4-lb. 744-page manual-size HANDBOOK contains carefully compiled service notes on over 4800 models of 202 manufacturers—practically every radio in use today. Statistics show it covers well over 90% of all jobs brought to servicemen! Everything fully indexed so you can find it quickly. Everything thoroughly explained.

Hundreds of additional pages contain i-f alignment peaks; transformer trouble listings; tube data; and dozens of graphs, diagrams and service data to help you repair ANY RADIO EVER MADE better, easier and TWICE AS FAST! Only $5 complete—and you don't risk a cent. Our 5-DAY MONEY-BACK GUARANTEE is your absolute protection. Use coupon.

only $5

MONEY-SAVING OFFER

Let the HANDBOOK save you time on common service jobs. Let MODERN RADIO SERVICING train you for truly professional work. Get BOTH big books at Combination Price of only $9.50 for the two. Use coupon today!

only $5

Be a Professional RADIO-ELECTRONIC SERVICE EXPERT

Don't be a low-paid service hack! Learn to service by modern, scientific analysis methods. Qualify for the big money work, not only in servicing but in all sorts of industrial electronics. Get the real KNOW HOW of truly professional servicing—in a few short weeks—at home without an instructor—for only $5 complete!

Whether you're already in servicing or only planning to train for it, A. A. Ghirardi's 1300-page MODERN RADIO SERVICING will prove worth its weight in gold. Clear, illustrated instructions lead you step by step through a complete, easily understood MODERN SERVICING EDUCATION that can equip you for fast, accurate service on even the most complicated jobs. Endorsed by service experts everywhere. Used by leading schools. Unsurpassed for home study. "Borrow" it for 5 full days on our 5-DAY MONEY-BACK GUARANTEE PLAN. You be the judge!

1300 pages
706 illus.
766 subjects!

INSTRUMENTS! TROUBLESHOOTING! REPAIR!

MODERN RADIO SERVICING shows how to analyze circuits scientifically; how, when and where to use all types of test instruments; how to test, repair and replace components; how to make parts substitutions; how to handle every phase of radio-electronic repair work by MODERN methods.

HANDY SERVICE "GADGETS"

Use Ghirardi Gadgets and do radio set troubleshooting and repair with lightning speed! Just flip a card. Automatically, the Gadget indicates the tests and remedies to make for whatever the trouble happens to be.

HOME RADIO GADGET — Spots 400 different home receiver troubles — tells what tests to make—suggests how to repair the set. Only 50c.

AUTO RADIO GADGET — Indicates 444 special auto radio troubles in all possible sources for 11 common trouble symptoms. Only 50c.

5-DAY MONEY-BACK GUARANTEE

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☐ Enclosed find $........ for books checked, or ☐ send C.O.D. (no foreign C.O.D.'s) for this amount plus postage. If not satisfied, I may return books within 5 days for refund of my money.

☐ RADIO TROUBLESHOOTER'S HANDBOOK, $5 ($5.50 foreign)
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☐ MONEY-SAVING COMBINATION: Both big books—over 2040 pages—only $9.50 for the two ($10.50 foreign)
☐ HOME RADIO GADGET, 50c ☐ AUTO RADIO GADGET, 50c

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Address ....
City & Zone .... State.................

where he majored in mechanical engineering. He has traveled extensively and speaks several languages.

He will make his headquarters at the *Sprague* general offices, North Adams, Massachusetts.

* * *

HERBERT C. ELWES has been named Manager of Commercial Sound Sales of the *RCA Engineering Products Department.*

Mr. Elwes, who was formerly Merchandise Manager in the *RCA Theater Equipment Section,* will now direct sales of industrial sound systems for schools, factories, hotels, and other institutions.

He has been associated with *RCA* for 16 years during which time he served in various capacities with the company. From 1942 until 1946 he served as an officer in the Army Air Forces, returning to *RCA* upon receiving his discharge.

* * *

KARL KRAMER of *Jensen Mfg. Co.* was named Chairman of the Chicago Section of the Institute of Radio Engineers for the coming year, while Kenneth Jarvis, a consulting engineer, was named Vice-Chairman, and Don Haines of *Hytron Radio Corp.* was elected Secretary-Treasurer.

While activities of Chicago Section were suspended during the summer months, the first fall meeting will be held on September 19th with the new officers presiding for the first time.

* * *

H. L. PIERCE was recently named District Merchandising Manager of the Radio and Appliance Division of *The Sparks-Withington Company,* manufacturers of the *Sparton* line.

In his new position, Mr. Pierce will cover the territory of eastern Pennsylvania and southern New Jersey. Active in the electrical appliance business for 25 years, Mr. Pierce was most recently merchandising manager of the hard goods division of *Mercantile Stores Company, Inc.*

Mr. Pierce is forming his own company to be known as *H. L. Pierce & Associates.* This firm will merchandise the *Sparton* line.

* * *

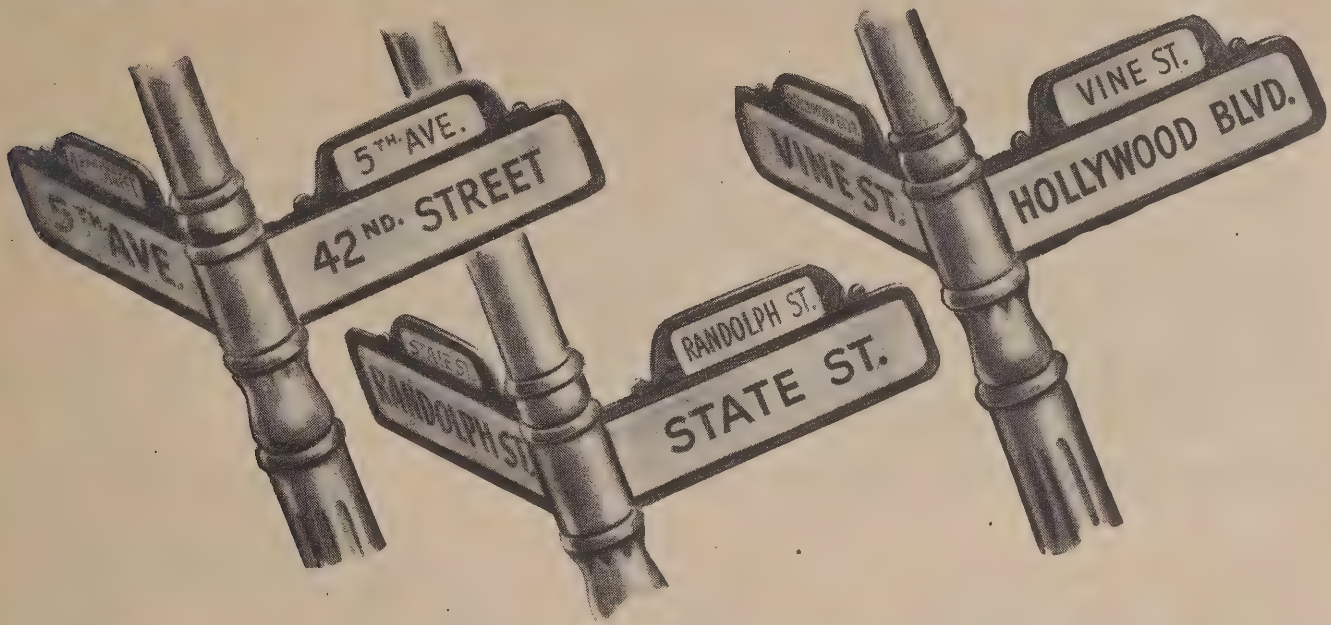
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION has announced the formation of a new electrical products group comprising eleven companies which manufacture induction and dielectric heating equipment.

Chairman of the group, known as the Induction and Dielectric Heating Apparatus Section, is Dr. H. B. Osborn, Jr., Sales Manager of the Tocco Division of *The Ohio Crankshaft Company* of Cleveland. C. W. Miller, Sales Manager of the Industrial Electronics Division, *Westinghouse Electric Corp.,* of Baltimore is Vice-Chairman.

The section will set up equipment standards and ratings, safety require-

(*Continued on page* 170)

Q. WHAT'S NEXT-BEST TO HAVING YOUR SERVICE SHOP LOCATED ON A FAMOUS BUSY CORNER?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The popular G-E monogram draws trade to you.

RADIO TUBES

Public confidence in a well-known, respected product is the voltage that sparks sales. Let radio owners know that you install and sell G-E tubes, and you've taken the first big step toward increasing your volume of business.

Postwar buyers are demanding "name" merchandise. With G-E tubes, you offer customers the brand-name that LEADS in quality, reliability, and engineering advancement . . . stamping you as a preferred source for tube purchases and trustworthy radio repair work.

Greater patronage of your shop, a bigger volume of service work, faster tube turnover—all these come packaged in the familiar orange-and-blue General Electric cartons. Act *now* to reap the reward that will accrue from establishing your shop as local G-E tube headquarters! *Electronics Department, General Electric Company, Schenectady 5, New York.*

***And General Electric helps you actively promote your business!* Write for Sales-aids Booklet ETR-51, which describes the colorful G-E line of tube window displays, direct-mail pieces, and numerous other items useful for widening your client-list and selling more service, tubes, and parts.**

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FIRST AND GREATEST NAME IN ELECTRONICS

A SIGN OF SUCCESSFUL SERVICING

Community has all fifteen Rider Manuals*

**(and Volume XVI on order)*

In national magazines it's the successful shops that are featured editorially. Note how many carry photographs showing complete libraries of Rider Manuals. Community Radio and Electric Service of Wilkinsburg, Pa. is an example; was recently featured in Radio Retailing for its "Plus-Service". At Community you will find all fifteen volumes in daily use. For, from no other single source is such essential information available to shops called upon to service all makes and all types of radio receivers — of all ages.

For this reason the first fourteen volumes of Rider Manual are time-savingly essential to the average shop. These volumes alone cover the years when over 80% of the sets now in American homes were issued. (From 1920 to 1942 inclusive.)

Too, the information on these receivers is the OFFICIAL AUTHORIZED servicing data direct from the service departments of the companies that made the sets. No one knows better than the manufacturer what procedures are best for his product. That is the basis for the authority and the success of Rider Manuals.

And you get this dependable information at the earliest possible date. For, Rider Manuals are now being issued three times a year!

Rider Manuals are investments. They keep pouring out profits for you. Copies of Volume 1, bought 17 years ago, are still benefiting their owners. So, be sure your shop has the sign of successful servicing — all fifteen Rider Manuals.

RIDER MANUALS NOW IN 16 VOLUMES

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2000 Pages, plus 200 page "How It Works" Book

Covers sets issued during 1946 and some previously unpublished prewar models. Contains 530 Rider-exclusive "clarified-schematics."

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MEAN **SUCCESSFUL SERVICING**

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RIDER MANUAL

704 Pages . . . $6.60
PLUS SEPARATE "HOW IT WORKS" BOOK

Important Policy Announcement

Because of the current high, receiver production rate, Rider Manuals will be issued three times a year, as long as existing conditions continue. This will provide independent servicemen and dealer-service-shops with complete information at the earliest possible date, on those new sets which may require adjustment or repair. This accelerated publishing schedule is but another example of our alertness to meet your radio receiver servicing data needs with greatest economy to you. Rider Manuals represent, "Seventeen Years of Service to the Servicing Industry".

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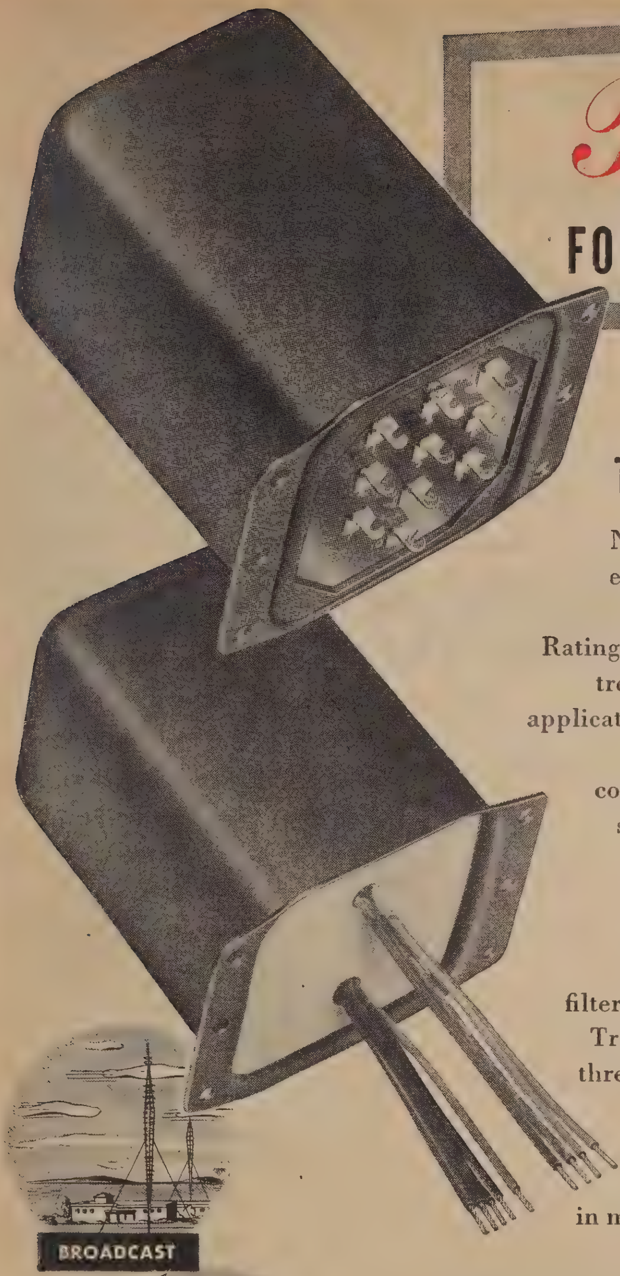
FOR TODAY'S NEW CIRCUITS



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New and up-to-date, yet embodying all the quality, precision engineering and outstanding construction features for which Chicago Transformers have long been recognized. Ratings have been skillfully selected by men who know the latest trends in circuit design. They provide maximum flexibility in application and close matching with today's most widely used tubes. Audio transformers have 600/150-ohm impedances and contribute to product performance which not only meets but surpasses RMA and FCC standards for high quality reproduction, uniform frequency response over the required ranges, and freedom from distortion. Power transformers meet or surpass RMA standards for temperature rise and insulation test voltages. Combined in the power series are filter reactors with conveniently matched D.C. current ratings. Transformers and reactors are mounted in drawn steel cases in three variations of CT's famous "Sealed In Steel" construction. This provides protection against atmospheric moisture, efficient magnetic and electro-static shielding, strength and rigidity to withstand shock and vibration, convenience in mounting, compactness, and clean, streamlined appearance.

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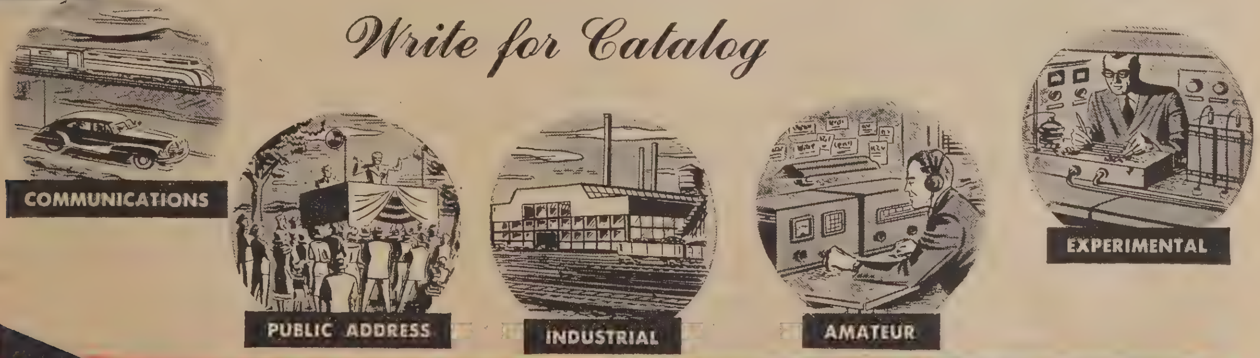

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Why spend years learning Electricity or Radio, when COYNE prepares you for good jobs in either field in a few short weeks? Our training not only saves time; you're ready to step into the better pay that much sooner. You make rapid progress because you work under expert instructors here in our great shops. We do not teach by mail. Select course you prefer and send coupon TODAY!

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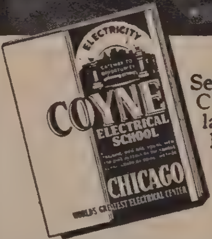
Big future in Power Plant Work, Motors, Armature Winding, House and Factory Wiring, Industrial Electronics, Home Appliances, Lighting, Auto Electricity, Electrical Maintenance — all covered at COYNE. Here you get "all-around" Electrical training!

TRAIN ON REAL EQUIPMENT

You use, test, repair full-size apparatus — just like you'll later handle on the job. Previous experience unnecessary.



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Send now for big, illustrated book on COYNE Electrical Training. Many large pictures of our shops. Tells about Free Lifetime Employment Service to **Coyne** graduates. Other vital facts. Check coupon for "ELECTRICITY" and mail today.

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ELECTRONICS
TELEVISION
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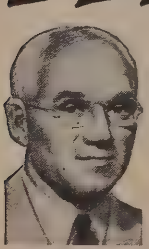
COYNE HAS BEEN TRAINING MEN SINCE 1899



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ADDED TRAINING in ELECTRIC REFRIGERATION included with either course

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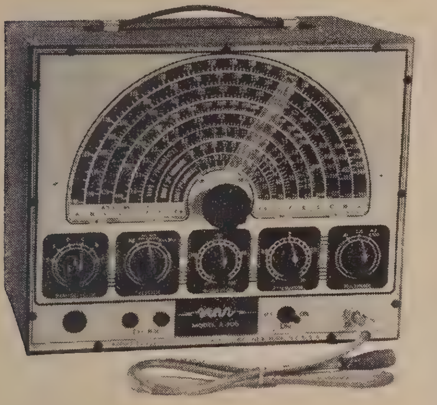
SIGNAL GENERATOR



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A —100-250 Kilocycles
B —190-500 Kilocycles
C —420-1000 Kilocycles
D —1000-3000 Kilocycles
E —3.0-9.0 Megacycles
F —9.0-25 Megacycles
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F_3—27-75 Megacycles

External Modulation possible at from 40 to 30,000 Cycles.

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Phase Shift Audio Oscillator and Internal Modulator.
A. C. Operation. 105 to 120 Volt. 5′to 60 Cycles.
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3 Step RF Attenuator.
Continuously Variable RF-AF Fine Attenuator Control.
Heavy Gauge Non-Warping Lucite, Fabricated Dial Pointer.
Tubes used are as follows:
  1—6SN7 - RF Oscillator
  1—6SH7 - AF Oscillator and Modulator
  1—6SH7 - Cathode Follower Output Stage
  1—6x5 - Rectifier
Negligible Harmonic Output (2nd Harmonic 28 DB Down as measured against higher priced units).
Specially Designed Ultra Stable Two Terminal RF Oscillator.
Pilot Light Line Indicator.
Cathode Follower Output Tube (attenuator settings have no effect whatever on frequency).
Modulation Percentage continuously variable from front panel, internal or external, 0 to 100%.
Co-Axial Output Lead Furnished.

The Model A-200 Signal Generator is enclosed in a heavy 16-gauge steel cabinet, battleship grey, crackle finish. Complete with 4 (standard brand) tubes, Amphenol Co-axial connecting cable, ground cable, operating instructions, circuit diagram and guarantee.

Net Weight: 16½ lbs.
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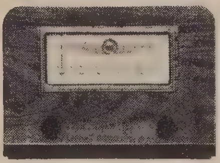
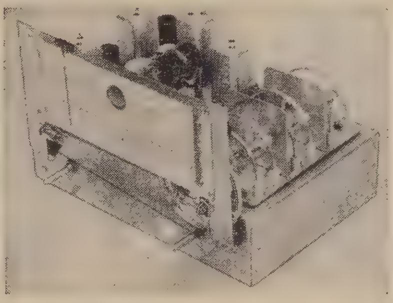


Illustrated is front panel of cabinet. Price includes cabinet.



THE OUTSTANDING
F-M TUNER OF THE YEAR!

SPECIFICATIONS

POWER SUPPLY: 117 volts, 60 cycles
POWER CONSUMPTION: 35 Watts
CIRCUIT: Superheterodyne
TUNING RANGE: 88-108 Mc
INTERMEDIATE FREQUENCY: 10.7 Mc (Iron core tuned, ceramic insulation)
BAND WIDTH: 150 KC
SENSITIVITY: 10 microvolts for full limiting
FREQUENCY DRIFT: negligible after 5 minutes
OUTPUT VOLTS: Average 2 volts RMS.
OUTPUT IMPEDANCE: 500,000 ohms
HUM LEVEL: 70 db below average output
8 TUBES: 1—6AG5 R.F. Amplifier
  1—6J6 Oscillator, mixer, detector
  2—6SH7 I.F. amplifiers
  1—6SH7 Limiter
  1—6AL5 Discriminator
  1—7Y4 Rectifier
  1—6U5 Indicator (Tuning Eye)
ANTENNA: 300 ohm line (Dipole)
CHASSIS: No. 16 U.S.S.G. Steel Cadmium plated .0003
WEIGHT: Approx. 15 lbs. (packed)
CHASSIS DIMENSIONS: 8x12x3x8½″
DIAL: Sliderule
DIAL OPENING: 3x7⅜
POINTER TRAVEL: 6
TUNING RATIO: 16:1
TUNED LINES: Brass, silver overlay .0005 thick
CONTACT SPRINGS: Phosphor bronze, silver overlay, .0005 thick
CONTACT ARMS: Lucite bars
FRONT END: Unit construction, floated
CABINET: Walnut Veneer, hand rubbed (13″W, 9¾″ H, 10″ D)
CONTROLS: Tuning control—Volume control with "on/off" switch
  Chassis, complete with tubes, built-in power supply, installed in cabinet

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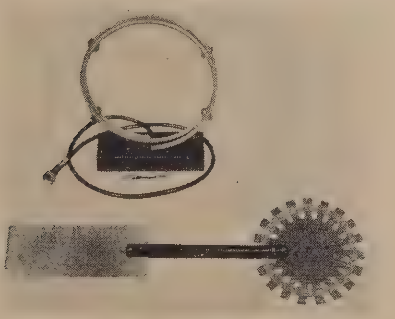

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BLILEY 186.30kc in type MC 72 Holder. **59c**

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412kc
413
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429kc
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505kc
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49¢ EACH

I. F. FREQUENCY STANDARDS

450kc
451.388kc
452.777kc
454.166kc
455.556kc

459.259kc
461.111kc
464.815kc
465.277kc

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525kc
526.388
527.777
529.166
530.555
531.944

533.333
534.722
536.111
537.500
538.888

99c

FOR HAM & GENERAL USE

Fractions Omitted

390kc
391
392
393
394
395

396kc
397
398
401
402
403
404

405kc
406
407
408
409
411

79c

ASSORTED MISCELLANEOUS CRYSTALS

Fractions Omitted

370kc
372
374
375
376
377
379

380kc
381
383
384
386
387
388

39c

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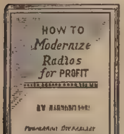

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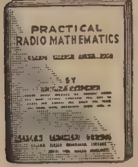

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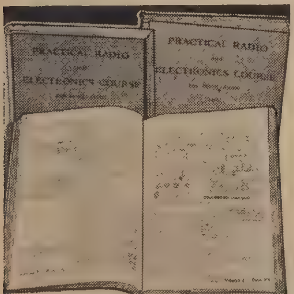

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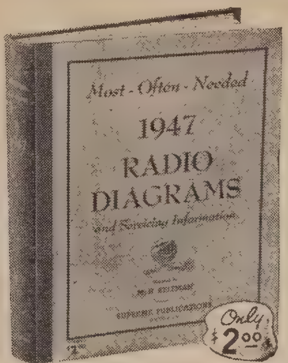

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T6-D5	.005	600	3/8	1 3/16	.25
T6-D6	.006	600	3/8	1 3/16	.25
T6-S1	.01	600	7/16	1 3/16	.30
T6-S2	.02	600	7/16	1 3/16	.30
T6-S5	.05	600	9/16	1 5/8	.40
T6-P1	.1	600	5/8	1 3/4	.45
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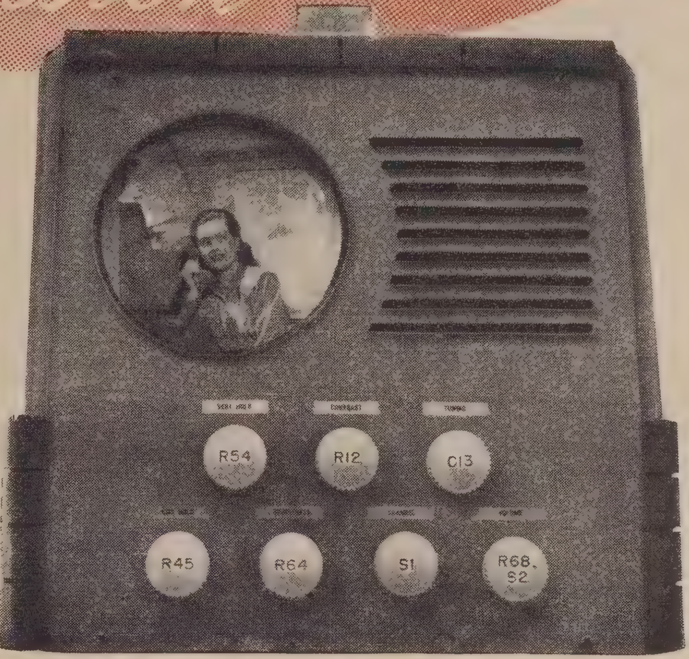
Learn as you build—Television

By ARTHUR LIEBSCHER
Television Consultant, RADIO NEWS

Complete construction details for an experimental type television receiver. The 3" video tube makes possible simple circuit design and reduces unit cost.



Front panel view of television receiver. The cabinet was home constructed. Controls from left to right are; (top) vertical hold, contrast, tuning, (bottom) horizontal hold, brightness, channel, and volume.

FOR those who believe in learning by doing, the construction of a miniature 18 tube television receiver described here provides a practical way of becoming acquainted with the basic requirements of both picture and FM sound reception.

There are three ways in which this small video receiver can be assembled; first, by the usual method employed by experienced constructors in following the schematic diagram and referring to a photo of the completed set; second by following a step-by-step procedure in mounting and wiring parts as guided by a series of construction photos; and third, by typical factory production methods.

A school, for instance, can teach mass production as well as the technical side of television, by arranging for a group of students to build a number of sets simultaneously, each being assigned to one operation at a time and personally applying it to all units under construction. Even those with experience will find considerable pleasure in the step-by-step method of assembling numbered parts and thus gradually bringing the entire television set into being.

It is the purpose of this article to explain the construction by the method most commonly practiced, by means of the schematic and photographs.

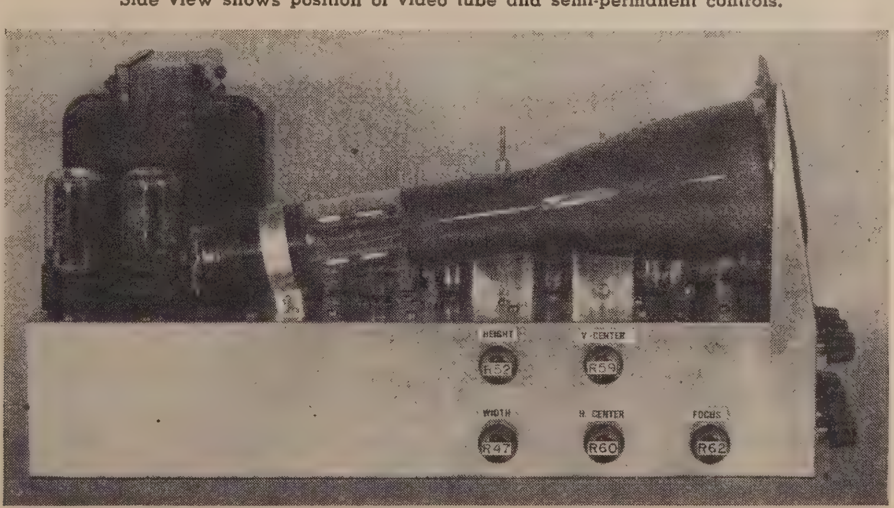
Many constructors prefer to work from factory-size blueprints. A 16" x 24" blueprint of the schematic shown on page 40 is available from the author at $1.00 per copy. Send your requests along with a remittance of $1.00 to Arthur Liebscher, 7618 Fayette Street, Philadelphia 38, Pennsylvania.

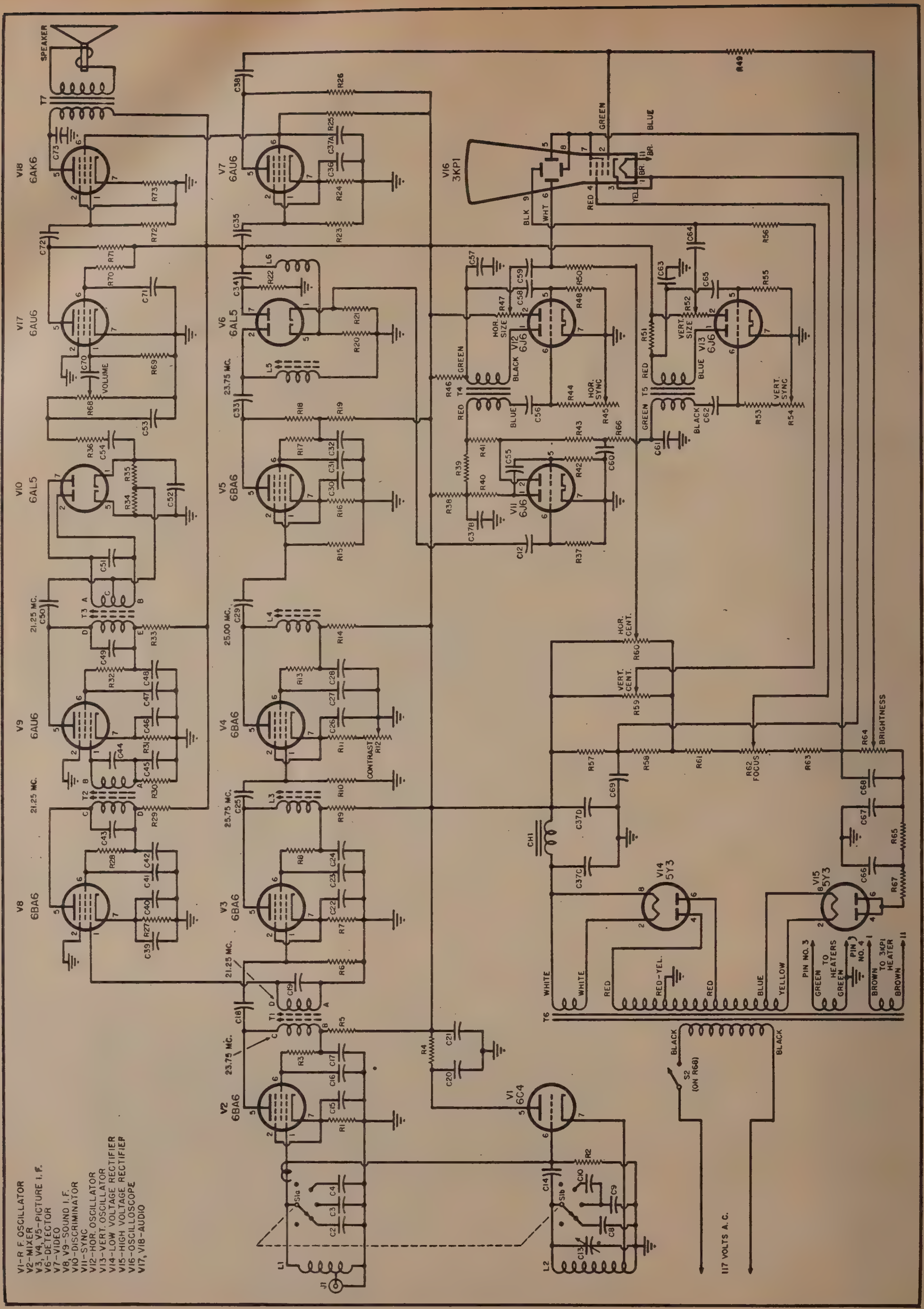
Chassis Layout

Due to the care required in developing compact high frequency electronic equipment and in particular the consideration of lead lengths and component placement, it is highly desirable that the layout of the original model be copied as closely as possible.

The r.f. "head end" including the tuning facilities, oscillator, and mixer tubes are grouped at the front of the

Side view shows position of video tube and semi-permanent controls.



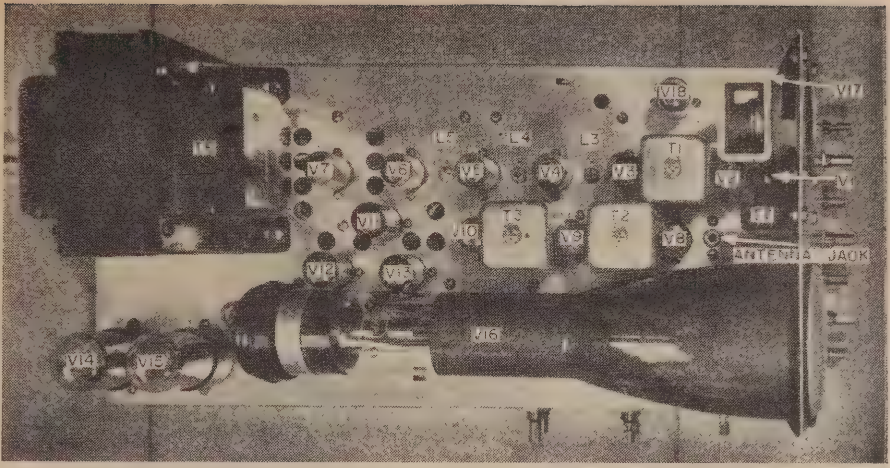

V1-R F. OSCILLATOR
V2-MIXER
V3, V4, V5-PICTURE I. F.
V6-DETECTOR
V7-VIDEO
V8, V9-SOUND I. F.
V10-DISCRIMINATOR
V11-SYNC
V12-HOR. OSCILLATOR
V13-VERT. OSCILLATOR
V14-LOW VOLTAGE RECTIFIER
V15-HIGH VOLTAGE RECTIFIER
V16-OSCILLOSCOPE
V17, V18-AUDIO
SPEAKER
T7
V18 6AK6
V17 6AU6
VOLUME
V10 6AL5
21.25 MC.
V9 6AU6
V8 6BA6
V7 6AU6
V6 6AL5
23.75 MC.
V5 6BA6
25.00 MC.
V4 6BA6
CONTRAST R12
25.75 MC.
V3 6BA6
V2 6BA6
V1 6C4
V16 3KP1
GREEN
BLUE
HOR. SIZE
V12 6J6
HOR. SYNC
VERT. SIZE
V13 6J6
VERT. SYNC
V11 6J6
HOR. CENT.
VERT. CENT.
BRIGHTNESS
R62 FOCUS
CH1
V14 5Y3
V15 5Y3
PIN NO. 3 TO HEATERS
PIN NO. 4
BROWN TO 3KP1 HEATER
WHITE
RED
RED-YEL.
YELLOW
BLACK
S2 (ON R68)
117 VOLTS A.C.
T6
J1
L1
L2
S1a
S1b

Complete schematic diagram of a.c.-operated 18 tube table model television receiver.

chassis for obvious ease of control. Immediately following the r.f. section is the first picture i.f. stage and this is in turn followed closely by the succeeding picture i.f. stages, the detector, and, last, the video amplifier. You will note that this entire picture signal section is laid out in a straight line, terminating where the output can be applied directly to the base of the cathode-ray tube.

The sound i.f. channel is "tapped off" of the mixer output and it too, runs in a straight line layout through the two i.f. stages to the FM discriminator tube (V_{10}). The audio signal is conducted back to the volume control on the front panel and then through the two audio amplifier stages grouped at the right side of the chassis under the speaker. This makes the

(*Continued on page 42*)



Top view shows placement of component parts. The chassis is 15"x7"x3". In order to conserve space, all component parts should be as small as possible, resistors and condensers should be of the insulated type. It is of utmost importance that the constructor follow the original layout of parts as closely as possible in order to duplicate the results which have been achieved by the author.

R_1, R_7, R_{11}, R_{16}, R_{27}—68 ohm, ½ w. res.
R_2—24,000 ohm, ½ w. res.
R_3, R_8, R_{13}, R_{17}, R_{28}, R_{32}—47,000 ohm, 1 w. res.
R_4—2200 ohm, 1 w. res.
R_5, R_9, R_{14}, R_{19}, R_{29}, R_{33}, R_{39}, R_{73}—1000 ohm, ½ w. res.
R_6, R_{18}, R_{21}—6800 ohm, ½ w. res.
R_{10}—8200 ohm, ½ w. res.
R_{12}—10,000 ohm rheostat (IRC DS 14-116)
R_{15}—5600 ohm, ½ w. res.
R_{20}—3900 ohm, ½ w. res.
R_{22}, R_{49}, R_{56}, R_{70}—1 megohm, ½ w. res.
R_{23}, R_{50}, R_{72}—470,000 ohm, ½ w. res.
R_{24}—120 ohm, ½ w. res.
R_{25}—33,000 ohm, 1 w. res.
R_{26}—8200 ohm, 2 w. res.
R_{30}, R_{34}, R_{35}, R_{57}, R_{58}—100,000 ohm, ½ w. res.
R_{31}—100 ohm, ½ w. res.
R_{36}, R_{43}, R_{66}—10,000 ohm, ½ w. res.
R_{37}, R_{42}, R_{48}, R_{53}—2.2 megohm, ½ w. res.
R_{38}—3300 ohm, 1 w. res.
R_{40}—15,000 ohm, 1 w. res.
R_{41}—10,000 ohm, 1 w. res.
R_{44}—3300 ohm, ½ w. res.
R_{45}—50,000 ohm rheostat (IRC DS 11-123)
R_{46}, R_{65}—220,000 ohm, ½ w. res.
R_{47}—50,000 ohm pot.
R_{51}—1.5 megohm, ½ w. res.
R_{52}—250,000 ohm pot. (IRC DS 11-130)
R_{54}—2 megohm rheostat (IRC DS 13-139V)
R_{55}, R_{69}—10 megohm, ½ w. res.
R_{59}, R_{60}, R_{62}, R_{68}—500,000 ohm pot. (IRC DS 11-133)
R_{61}—820,000 ohm, ½ w. res.
R_{63}, R_{71}—330,000 ohm, ½ w. res.
R_{64}—100,000 ohm pot. (IRC DS 11-128)
R_{67}—33,000 ohm, ½ w. res.
C_1, C_5, C_7—See text
C_2—15 μμfd. ceramic cond.
C_3—10 μμfd. ceramic cond.
C_4, C_8—6.8 μμfd. ceramic cond.
C_6, C_{11}—Not used
C_9—4.7 μμfd. ceramic cond.
C_{10}—8.2 μμfd. ceramic cond.
C_{12}, C_{35}, C_{55}, C_{57}, C_{72}—.01 μfd., 600 v. cond.
C_{13}—Var. cond.*
C_{14}—56 μμfd. ceramic cond.
C_{15}, C_{16}, C_{17}, C_{18}, C_{20}, C_{21}, C_{22}, C_{23}, C_{24}, C_{25}, C_{26}, C_{27}, C_{28}, C_{29}, C_{30}, C_{31}, C_{32}, C_{33}, C_{39}, C_{40}, C_{41}, C_{42}, C_{45}, C_{46}, C_{47}, C_{48}, C_{53}, C_{58}, C_{59}—1000 μμfd. ceramic cond.
C_{19}—Part of T_1
C_{34}, C_{64}, C_{69}—.1 μfd., 400 v. cond.
C_{36}—25 μfd., 25 v. elec. cond.
C_{37A}, C_{37B}, C_{37C}, C_{37D}—20/20/20/20 μfd., 450/450/450/450 v. elec. cond.
C_{38}—.002 μfd., 1600 v. cond.
C_{43}, C_{44}—Part of T_2
C_{49}, C_{50}, C_{51}—Part of T_3
C_{52}—500 μμfd. ceramic cond.
C_{54}, C_{65}, C_{71}—.05 μfd., 400 v. cond.
C_{56}—820 μμfd. mica cond.
C_{60}, C_{61}, C_{70}, C_{73}—.005 μfd., 600 v. cond.
C_{62}—1500 μμfd. mica cond.
C_{63}, C_{68}—.25 μfd., 400 v. cond.
C_{66}, C_{67}—.1 μfd., 1600 v. oil-filled cond.
L_1—Ant. coil*
L_2—Osc. coil*
L_3, L_4, L_5—Video i.f. coil*
L_6—Peaking coil*
CH_1—Filter choke*
T_1—First i.f. trans.*
T_2—Sound i.f. trans.*
T_3—Discriminator trans.*
T_4—Horizontal osc. trans.*
T_5—Vertical osc. trans.*
T_6—Power trans.*
T_7—Output trans.*
J_1—Ant. connector jack
S_1—5 pos., double-pole rotary selector sw.*
S_2—S.p.s.t. sw. on R_{68}
Speaker—2" PM speaker
1—3KP1 cathode-ray tube
2—5Y3 tubes
5—6BA6 tubes
3—6AU6 tubes
2—6AL5 tubes
1—6AK6 tube
1—6C4 tube
3—6J6 tubes
**—All special components are available from the author.*

Parts list for 3" television receiver. Schematic diagram is shown on page 40.

Chart gives actual operating voltages at socket connections of the various tubes.

Tube	Pin No. 1	Pin No. 2	Pin No. 3	Pin No. 4	Pin No. 5	Pin No. 6	Pin No. 7	Pin No. 8	Pin No. 9	Pin No. 10	Pin No. 11
V_1	+270	—	6.3 a.c.	0	+270	—15	0				
V_2	0	+1.6	6.3 a.c.	0	+290	+72	+1.6				
V_3	—.5	+1.2	6.3 a.c.	0	+295	+115	+1.2				
V_4	0	+1.2/+36	6.3 a.c.	0	+290/+310	+100/+280	+1.2/+36				
V_5	0	+1.2	6.3 a.c.	0	+210	+100	+1.2				
V_6	0	0	6.3 a.c.	0	+.2	—	—.7				
V_7	0	+1.3	6.3 a.c.	0	+240	+170	+1.3				
V_8	0	0	6.3 a.c.	0	+285	+100	+1				
V_9	+.1	0	6.3 a.c.	0	+290	+160	+1.1				
V_{10}	0	—.4	6.3 a.c.	0	0	—	—.4				
V_{11}	+100	+100	6.3 a.c.	0	—.8	—.9	0				
V_{12}	+8/+40	+90/+210	6.3 a.c.	0	—1/—7	—4/—13	0				
V_{13}	+100/+140	+90/+120	6.3 a.c.	0	—2.8/—4	—44/—62	0				
V_{14}	—	+380	—	400 a.c.	—	400 a.c.	—	+380			
V_{15}	—	910 a.c.		—980/—1020		—980/—1020	—	910 a.c.			
V_{16}	—620/—800	—580/—680	—620/—800	—220/—610	+220/+270	+215/+300	+220/+270	+220/+270	+210/+280	—	—620/—800
V_{17}	.9	0	6.3 a.c.	0	+95	+45	0				
V_{18}	0	0	6.3 a.c.	0	+280	+170	+10				

Note: Line voltage is 117 v., 60 cycles. Meter used is RCA Voltohmyst. No external signals applied. See schematic diagram for pin numbers.

audio output convenient to the panel mounted transformer and speaker.

Synchronizing and deflection tube circuits are placed at the end of the picture channel, where their high level signals are least likely to interfere with the sensitive input circuits.

The power supply is logically placed at the rear of the chassis, thus allowing its heat to ventilate away from most components. The power transformer is purposely mounted with its core at right angles to the cathode-ray tube in order to minimize magnetic hum deflection, which would in turn cause an "s" bend in the picture.

The vent holes are grouped in the top of the chassis at locations where maximum heat must be dissipated. This, plus a perforated base plate and four quarter-inch high feet, serves to provide sufficient ventilation.

Five semi-permanent adjustment controls are clustered on one side of the chassis. They can either be slotted for screw driver adjustment or used with knobs to center and focus the picture as well as adjust its size. The side controls, like the seven on the front, all have shafts cut to one-half inch beyond the mounting thread. If the set is to be installed in a cabinet later, it will be found convenient to simply add shaft extensions to each of the front controls.

Selecting Parts

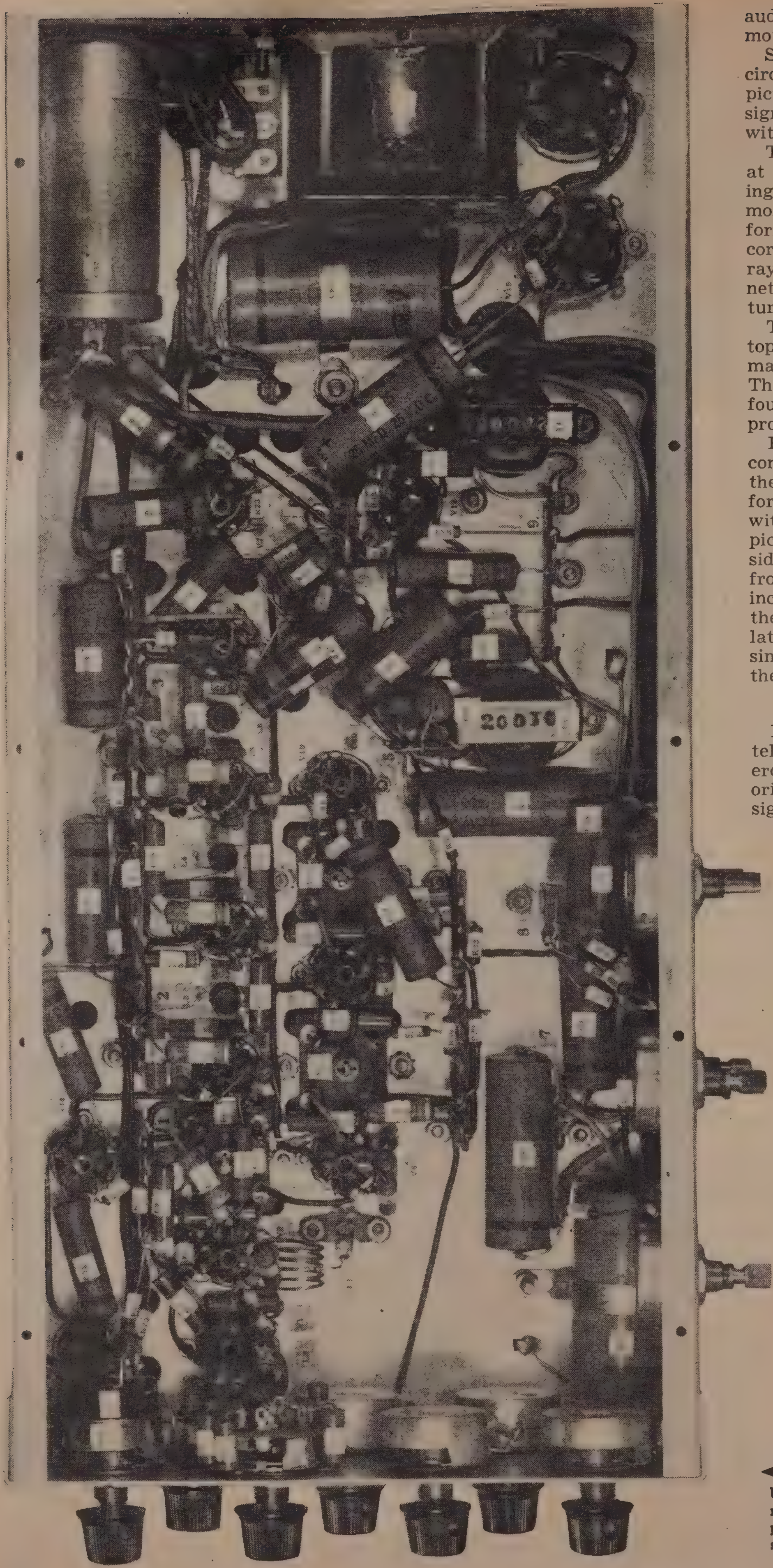
In obtaining parts for the miniature television receiver, care should be exercised in duplicating as many of the original components used in the design models as possible.

Because of the compactness of layout, the size of some items becomes an important factor. This is evidenced in the use of a number of 400 volt paper condensers in lieu of the usual 600 volt size. It is also true of the i.f. transformers, which for the sake of maintaining short leads, are placed directly next to their associated tubes. If a neat wiring job is expected, all resistors and ceramic condensers must be of the insulated type and they must also be small enough to allow room for other nearby parts.

From the standpoint of electrical specifications, little need be said about the importance of obtaining i.f. coils and transformers which can be relied upon to tune properly when a signal is applied. The power and a.f. transformers, too, must be selected for their conformance to the original types.

All the parts should first be accumulated and then checked against the parts list. They should then be laid out on a suitable table area in groups, with

(*Continued on page* 133)



Under chassis view of completed television receiver. All leads should be as short as possible and placement of component parts should follow the author's layout closely.

Servicing Television Receivers

By

PAUL H. WENDEL

Associate Editor, RADIO NEWS

Care must be exercised in repairing TV sets to prevent serious personal injury. Video tubes that may implode and high voltages are danger spots.

All video tubes are implosive by nature. The larger they are the more dangerous they become and therefore should always be handled with care.

LATE in 1946 the first of the postwar television receivers were made available to the public. First sold in the areas where television broadcast programs were on the air, the sales campaigns have been expanded to cover new teleserved areas as additional broadcasting stations are put into operation.

To date the independent radio service dealers have been merely interested bystanders in the video receivers service programs. The initial manufacturers with a tremendous financial investment in video research and development to protect, have buttressed their television sales programs with factory-controlled installation and service. The standard practice now is to charge the customer a flat fee for the installation and for one year's service on the receiver.

Practically all television receiver manufacturers are convinced that factory-controlled service will not be practical when television programs become available in all major areas. They feel that as soon as independent service dealers acquire the know-how and equip their shops with the test equipment essential for video receiver servicing, this activity should be handled by these qualified independent service organizations.

During the war when blithe imaginations drew fanciful word pictures of the flood of spectacularly new products that would enliven our lives after the dawn of Peace, many radio servicemen looked hopefully for the coming of television as the source of bigger and more profitable service business. Television is now here and in the cold light of business reality servicemen are able to appraise the practical potential of television servicing and what it will take to be able to handle video receiver servicing profitably. It will present new problems unlike anything previously handled in radio repair shops and will require the skillful use of test equipment comparable to the precision equipment of a first-class radio laboratory.

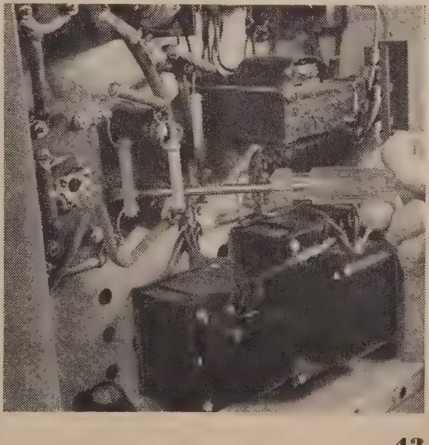
The frequencies now allocated to television range up to 216 mc., and the trend toward larger direct viewing and projection tubes means that radio servicemen will face new problems of high voltage at high frequency. In direct-viewing sets voltages will range from 2500 to 10,000. Projection type tubes will require voltages as high as 30,000.

These high voltages create a problem of serious hazard to the set owner, the radio serviceman and the equip-

(*Continued on page* 151)

Don't ignore warnings of high voltage or take chances as this serviceman is doing.

Always discharge high voltage condensers before touching internal components.



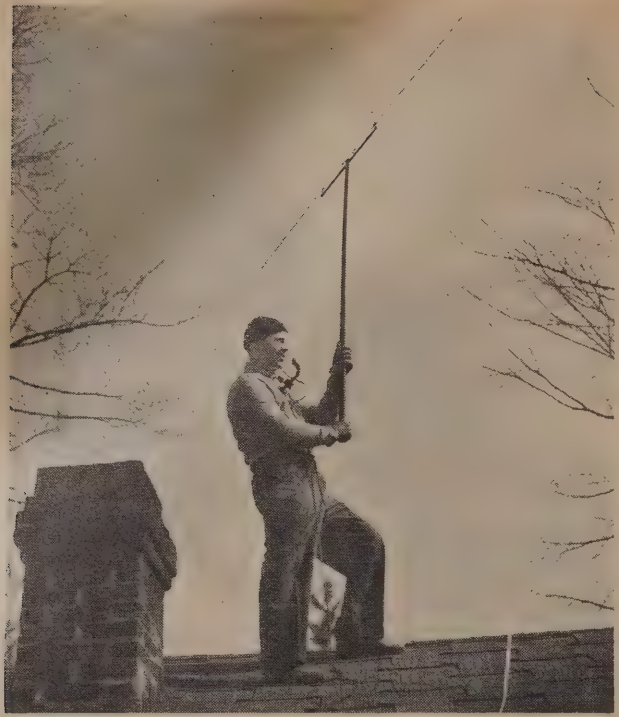


Fig. 1. The best location for television antenna is determined by testing various roof positions with a portable probing dipole, connected to the television set. Results are communicated to technician on roof by means of a telephone network.

TELEVISION INSTALLATION

By

W. W. WAYE

Part 1. The dealer's bugaboo—TELEVISION INSTALLATION—and how to beat it. Introducing a series of articles covering the basic problems and procedures involved in the installation of TV units.

THE major headache that confronts television merchandising is the bugaboo of *installation*. As more and more television receivers reach the market, the problem assumes enormous proportions.

You, as a dealer or serviceman, can understand the problem only by realizing the important *need* for good installations.

You can beat the bugaboo by following a *Basic Procedure of Installation*—a simple and practical method, that's applicable to all types of commercial television receivers. This is plain talk about television installation. It's down-to-earth, and mostly *non*-technical. You don't have to be an engineer to make a good television installation.

Television, like any other business, must be successful to survive. But the key to sales success in television is more than just a good product, a good line of receivers. After every sale, it's a clear and important responsibility of the dealer to install the set in the buyer's home or place of business. You may be a crackerjack salesman on the showroom floor, but unless the television receiver is properly installed, your sales effort will be lost. Dissatisfied customers will not only squawk to *you,* but to their friends who may be on the verge of buying a set. Television, itself, gets a black eye that it doesn't deserve.

Recently in New York, a leading receiver manufacturer stated: "In running down complaints of faulty set operation, we found that 90 per-cent were due entirely to imperfect installations!" Then he added: "Many of the dealers involved frankly admitted they couldn't understand the *reason* for painstaking, time-consuming television installations." Unfortunately, this is typical.

Television is somewhat related to radio. But the difference between them is considerable—and important. You can't plunk a television set down anywhere and expect it to work efficiently. You can't slap up any old piece of wire in any position and use it for an antenna. You can't run any kind of lead-in wire haphazardly from antenna to receiver. You can't do a lot of things in television because a television set is a sensitive, precision instrument. It must be focussed like an expensive camera. And many of the circuit adjustments are extremely delicate. The antenna system deals with extremely short radio waves, and the receiver relies upon the antenna system to provide television station signals *as strong as possible.*

Fig. 2. Relative merits of various dipole locations (Fig. 1) are observed at the television receiver in terms of best signal strength and picture quality. Telephone relays results to man on the roof.

To achieve this both the antenna and lead-in are actually *tuned!*

The receiver is also sensitive to noise or electrical interference. Television pictures can be seriously distorted by nearby operation of neon signs, diathermy machines, motors, and generators. But such interference can be minimized, often eliminated entirely, by proper installation of the antenna and lead-in.

The lead-in usually consists of "twin-lead ribbon"—two parallel wires spaced and encased by a flexible ½-inch plastic ribbon. The length of the lead-in isn't limited or critical, but the path of lead-in is very critical, and must avoid all pipes and large metal objects to minimize noise-interference pickup.

A fixed, horizontal dipole is used for television reception. Mounted on a wooden pole or framework, the antenna assembly is usually located at the highest part of the customer's house or building. However, the exact site of the receiving antenna is determined experimentally. Later, orientation and tuning of the *mounted* dipole is accomplished in the same manner.

Two technicians or installers are required to do the job. One man is located on the roof (Fig. 1) and one man is stationed at the receiver (Fig. 2). They communicate with each other by means of small, portable telephone sets. With a loose lead-in connecting the antenna and receiver, various roof positions of a movable dipole are judged at the receiver *in terms of signal strength and quality of the observed television picture.* In this manner, the best antenna site is located, and the dipole is oriented and tuned with extreme precision. This is the critical part of the installation procedure.

A Few Facts

A television channel is a wide band of extremely high radio frequencies, containing both sight (video) and sound (audio) signals. Programs from a television station are broadcast on an assigned channel, according to federal allocation. A television receiver must be tuned or switched to that specific channel in order to see and hear the televised programs. At present, the most popular television channels are in the group: Channel 1—44 to 50 mc.; Channel 2—54 to 60 mc.; Channel 3—60 to 66 mc.; Channel 4—66 to 72 mc.; Channel 5—76 to 82 mc.; Channel 6—82 to 88 mc. Seven other channels exist at even higher frequencies, between 172 and 216 megacycles, but the above six channels are more generally used for commercial broadcasting and reception.

Your line of television receivers can switch to most of these six popular channels. But within any area, your sales territory, *all* of these channels are never allocated by the government. Therefore, you are *only* concerned with the one, two, or possibly three assigned channels—the one, two, or possibly three television stations *that can be received in your particular area!*

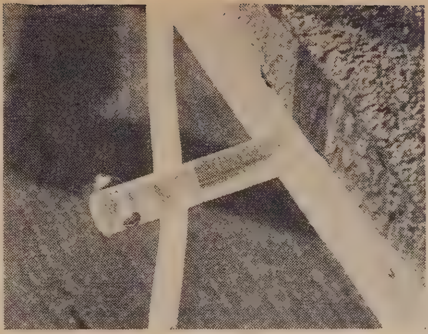


Fig. 3. Ideal lead-in for TV antenna is the "twin-lead ribbon." A polystyrene stand-off insulator is used.

Fig. 4. Two types of coaxial cables occasionally used for TV antenna lead-ins in noisy urban locations.

For Television Channel Number	Use Length (L) in inches
1	48.5
2	40.5
3	36
4	33
5	29
6	26.5
All 6	(mean) 37

Table 1. Proper length for 150 ohm matching section between 300 ohm lead-in and 72 ohm dipole for various television channels.

Because television is a short-range proposition, normal television reception is limited to 50 or 60 miles, due to the nature of the high-frequency waves. After leaving a station's transmitting antenna, they travel in straight lines. When they reach the horizon, they're lost for all practical purposes.

You can receive direct waves from a television station *only* if its transmitting antenna is visible, or "almost" visible, from the exact position of the receiving dipole. If the station's antenna can't be seen because of intervening buildings, or if the station's antenna is too far beyond the horizon, signals can't always be received. This explains the need for installing the receiving dipole as high as possible on the customer's house or building.

Most commercial types of television dipoles are premounted on four- or five-foot poles, which is a convenient height for most installations without guy wires. However, much higher framework or wooden towers can be used when it is necessary to raise the dipole above nearby houses or buildings obstructing the direct wave path of signals from a particular television station.

Before attempting any installation, you must know: 1. *Channel Numbers* of all television stations actively operating and normally heard in your area; 2. *Operating Schedule* of each station; 3. *Geographical Location* of the transmitting *antenna* of each station.

Assuming that three stations are operating at the same time and in the area of a television receiver equipped with an adequate antenna, *the three channels will not all be received with the same signal strength!* This is true because the air distance between each transmitting antenna and the receiving dipole will be different; the power transmitted on each television channel will be different; distant factors will influence the transmitted signals; and local factors will influence reception of the three signals.

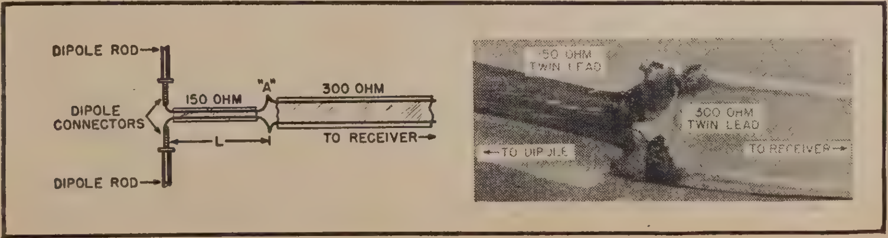
Thus, the installation of a television antenna is considered adequate if a single dipole can pick up two, *and only two,* of three, four, or more operating channels in the area.

The channel best received is called the *Primary Channel,* the second best is called the *Secondary Channel.* During later installation of the antenna, the dipole can be oriented and tuned to favor the personal preference of the customer, as to his choice of *Primary and Secondary Channels.*

It's possible, of course, that three, four, or more channels may be received well in unusual circumstances, but installing a single antenna for "best reception" means that the *Primary Channel* is received extremely well or strong, the *Secondary Channel* good or fairly well, and the other channels faintly or not at all.

At the outset, this limitation of a single dipole must be accepted by the buyer. If he demands excellent reception of *all* stations in the area, a separate and independent dipole must be used for each station or channel, with some suitable switching device. Of

Fig. 5. Method of constructing and connecting matching section to 300 ohm lead-in. See Table 1 for proper value of length, L, of twin-lead section.



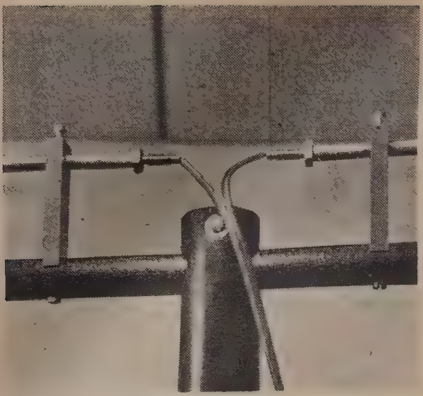


Fig. 6. Method of connecting matching section to center terminals of TV dipole.

For tuning antenna to Channel Number	Use Length for each rod, in inches
1	53.5
2	44.5
3	40
4	36
5	31.5
6	29.5
All 6	(mean) 41

Table 2. Length of each rod of dipole for tuning antenna to specific channels.

course the additional work would mean a much higher installation charge. The effectiveness of *any* television installation is proportional to its cost, with almost no limit.

Preparation

Prior to an installation, it's advisable to make a preliminary survey of the customer's house or building. Determine the customer's choice for *Primary Channel* and *Secondary Channel* reception. Establish the best interior location for the television receiver, based on the following factors (in order of importance): 1. Preference of customer for location of set; 2. Viewing distance recommended by manufacturer for the particular set. (Small screens require 3 or 4 feet. Large screens require from 6 to 10 feet); 3. Absence of sunlight. (Excessively bright light on picture tube or screen will spoil contrast); 4. Remoteness from electrical apparatus in the house or building, to minimize or eliminate electrical interference.

When these factors have been determined note the distance from this location to the nearest *appropriate* window, skylight, air duct, or other means of access to the roof.

On the roof pick the most likely location for the receiving antenna, at a high but fairly accessible part of the roof, then estimate the approximate distance from the probable antenna location, via window, skylight, or air duct, to the established interior position of the receiver.

Armed with this preliminary information, you can then assemble parts and equipment for the installation procedure. You will need the following: 1. Sufficient length of lead-in, based on estimated distance from the roof to receiver plus about 50 feet. (Specifications; 300-ohm "twin-lead ribbon" transmission line similar to type K-1046, *Federal Telephone and Radio Corp.*); 2. About 4 feet of special lead-in for matching section, to be connected between regular lead-in and dipole antenna. (Specifications; 150-ohm "twin-lead ribbon" transmission line, similar to above); 3. Stand-off insulators, for mounting lead-in, estimate quantity from survey. (Specifications; Polystyrene with screw mounting); 4. Fiber head nails for mounting lead-in, quantity as needed; 5. Commercial dipole antenna for television reception, with metal rods of suitable length, metal conductors, wooden supports and a four or five foot wooden mounting pole. (Specifications; Well-designed dipole providing adequate frequency discrimination and suitable directional properties with all tunable factors easily adjustable, similar to "*Shur* Television Antenna," *Shur-Antenna-Mount, Inc.*); 6. Heavy metal bracket for upright mounting of antenna pole on or against a vertical, slanting, or flat building surface. (Specifications; Must sustain weight of antenna without guy wires, must be sufficiently versatile to permit mounting on crest of roof, sloping sides or any horizontal or vertical surface, similar to "Adjustable Mount," *Shur-Antenna-Mount, Inc.*); 7. A small compass to locate direction of station transmitters on *Primary* and *Secondary* Channels; 8. A simple, two-wire, battery operated telephone system for two-way communications between roof and television receiver. (Specifications; Any inexpensive system, connecting wires must be covered and must be same length as 300-ohm lead-in); 9. Soldering iron, extra wire, nuts and bolts, tools, etc.; 10. Television receiver to be installed, shop-tested, and in good working order.

Two men—technicians, installers, or servicemen — are required for each complete television installation. Their work should progress strictly according to *Basic Procedure of Installation.*

There are four principal parts to the *Basic Procedure*: A. Locating the receiver; B. Preparing the lead-in; C. Siting the antenna; D. Orienting and tuning the antenna.

This *Basic Procedure of Installation* applies to all types of television receivers, without regard to make or model. It also applies to all types of single dipole antennas.

It's sufficiently general to cover all types of installations; remote houses, suburban residences, city dwellings, apartment houses, office buildings, and skyscrapers. In that order, however, the actual work becomes progressively more complex. Many of the details covering the more difficult types of installations will be considered in subsequent articles.

The Receiver

Handle the set carefully at all times, during delivery and during installation. Rough or improper handling often causes faulty operation of a set. Assemble the receiver, and place it in the desired location in the customer's home or office. Usually this position has been decided previously. The best location should be free of sunlight, allow sufficient viewing distance in front of the screen, and be sufficiently remote from electrical appliances. *But most important,* the final location must please the customer.

Place table models on strong, sturdy tables. Both table and console models require adequate ventilation. Don't

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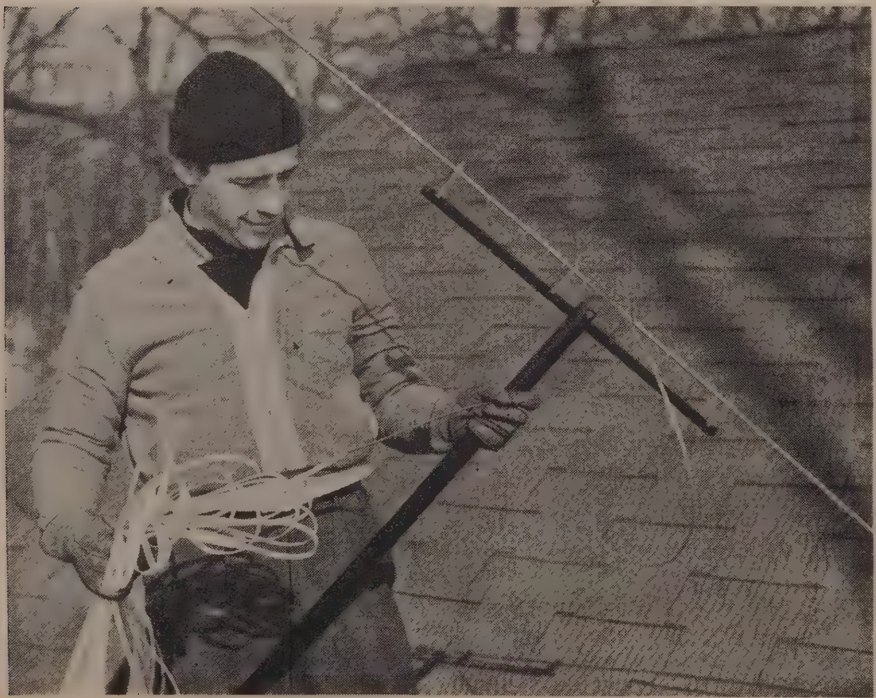
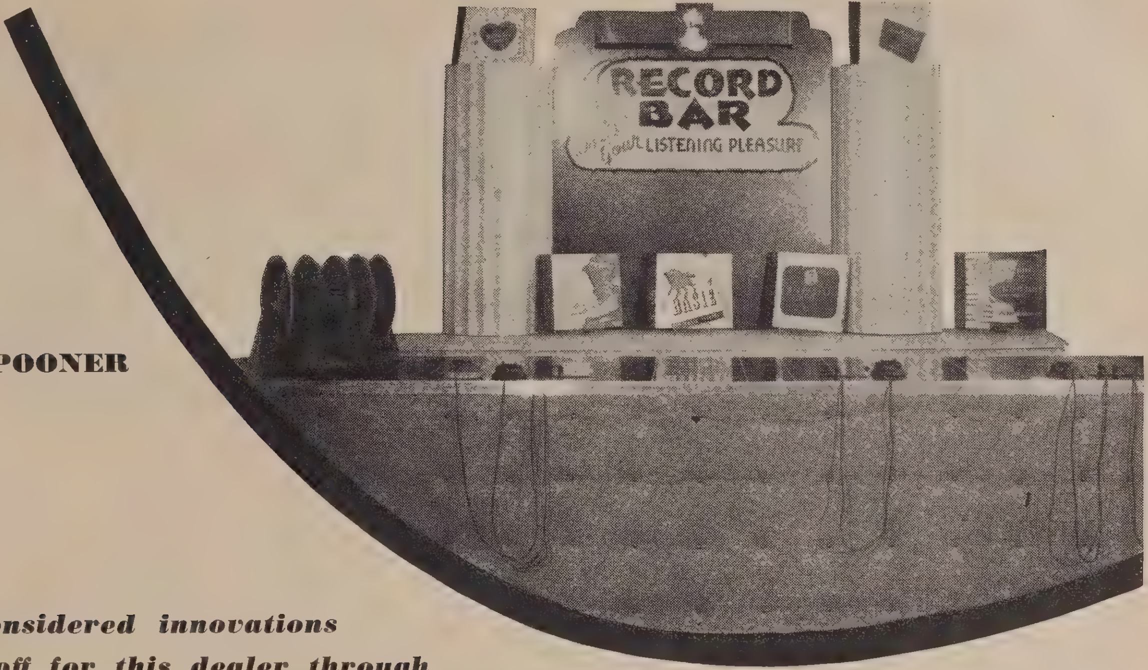
Fig. 7. Assembled dipole with lead-in and matching section attached ready for installation. Television technician shown is Jack McNally.



NEW RADIO OUTLET
Succeeds by Being Different



Increase your "listening capacity" by installing a record bar for your "pop" fans.

By
HARRY L. SPOONER

Carefully considered innovations are paying off for this dealer through increased sales and renewed customer acceptance.

BEING different sometimes pays off—at least *Smith & Applegate,* Peoria radio, record, and appliance dealers, are finding it so.

When their record business boomed and listening booth space was at a premium they installed a novel record bar which their "pop" record fans have adopted enthusiastically.

The record bar is 9 feet long. The front is covered with padded leatherette while the top is of tile linoleum. Below the top are four turntables which run into a 15 watt amplifier. Each turntable is equipped with two sets of earphones thus making it possible for eight persons to listen to four records simultaneously. The listener can control the volume by means of a volume control located on top of the bar. The bar has more than paid for itself during rush periods in the store when the two listening booths are busy. Students from Peoria High School and Bradley University are the biggest boosters for this innovation.

Back of the bar, against the wall, is a back bar which carries the invitation "Record Bar—What's Your Listening Pleasure?" Below this unit is a display of albums and needles. This display has promoted the sale of record accessories to a gratifying level.

Although this up-to-date, promotion-wise store is only a little over a year old, it is well-known in the community because the owners have dared to be different. Their advertising messages have blanketed the area through newspapers, direct mail, radio programs, and personal solicitation. Striking window displays and floor arrangements have backed this advertising to the hilt.

In spite of the fact that the store is only 62 x 175 feet, it boasts a full-fledged service department, both a heavy and traffic appliance department, a complete line of table and console radios, in addition to the ever-growing record department.

The two large display windows, which front on one of the main streets of Peoria, are made to pay off. Windows are changed every week—and residents of the city have come to expect something new, different, and attractive in the way of window displays. One of the windows is reserved for record promotion, the other is shared by the appliance and radio departments. Promotion tie-ins are utilized fully and visiting recording artists, bands, and soloists often come face-to-face with their pictures and records in *Smith & Applegate's* windows. These alert dealers know that

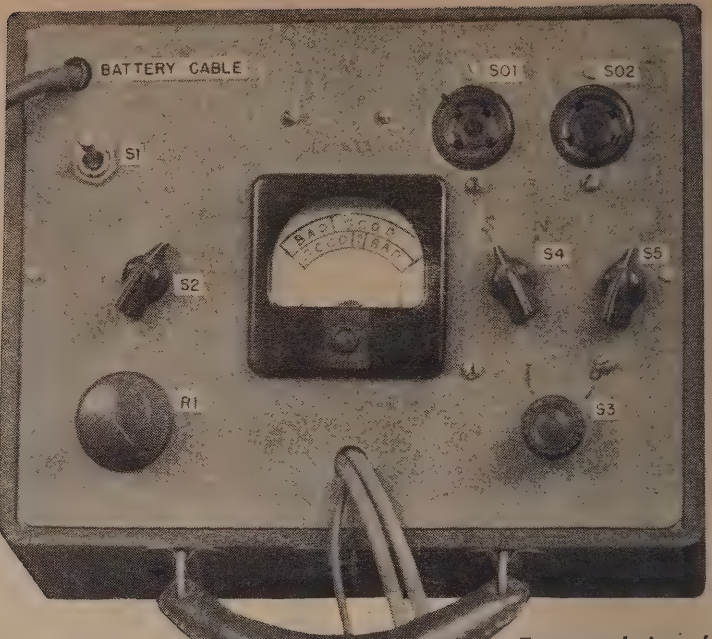
(*Continued on page* 165)

This uncluttered store layout permits Smith & Applegate to handle volume sales by directing traffic to related merchandising groups.

A *Practical* VIBRATOR TESTER

By
JOHN BOWLES

This easy-to-build tester checks both output and starting voltages of vibrators and provides "Good-?-Bad" analysis like conventional tube testers.



Front panel view of home-built vibrator tester. All parts are readily available.

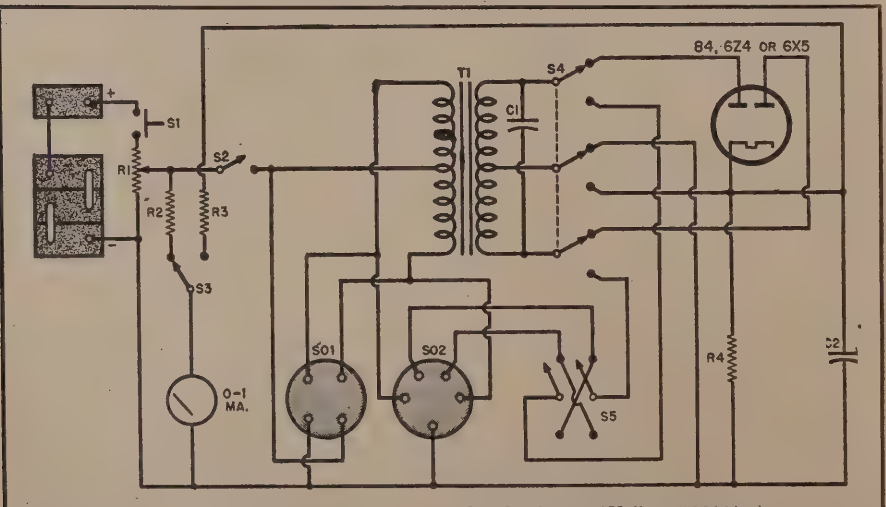
THERE has long been a need for a practical vibrator tester that tells the condition of a vibrator just as a tube tester indicates the performance of a tube. You can never feel quite sure that vibrator points are not worn to such a degree as to cause unsatisfactory service. While testing the tubes in an auto set it is also good practice to check the vibrator. Up to the present time there has been very little information as to how a vibrator could be quickly and accurately tested. As more autos come on the market there will be an ever greater number of auto radios to repair. Therefore, it is more important than ever to have a good vibrator tester.

This article describes a practical unit which may be built easily at little expense, mostly from spare parts.

The circuit for this instrument was designed by *P. R. Mallory & Co., Inc.* This tester is not elaborate and does not require special tools or equipment to build. Likewise, it is very simple in principle and is easy to use.

Fig. 1. Schematic diagram of vibrator tester. Meter movements other than the 0-1 ma. specified may be used provided resistors R_2 and R_3 are changed accordingly.

Courtesy of P. R. Mallory & Co.



R_1—1 ohm, 100 w. pot.
R_2—10,000 ohm, ½ w. res. ± 1%
R_3—500,000 ohm, ½ w. res.
R_4—5000 ohm, 50 w. wirewound res.
C_1—.01 µfd., 1600 v. cond.
C_2—8 µfd., 450 v. elec. cond.
S_1—S.p.s.t., 20 amp. push-to-close sw.
S_2—S.p.s.t. rotary sw.
S_3—S.p.d.t. sw. (Mallory #2003)
S_4—3-pole, 2-pos. sw. (Mallory #3243J)
S_5—D.p.d.t. sw. (Mallory #3222J)
Meter—0-1 ma. d.c. meter
T_1—Vibrator trans. 6 v. pri.; 260 v. d.c. sec. @ 60 ma. to filter input
Tube—84,6Z4, or 6X5

The meter on the tester may be marked *"GOOD," "DOUBTFUL,"* and *"BAD."* It is just as simple to use as a tube tester marked in the same manner.

With the best quality parts, the tester does not cost more than twenty-five dollars to build. It may be made from spare parts found in your "junk box" with correspondingly lower cost. It takes very little time to assemble the parts, and the wiring is not at all complicated. The time spent in building it, in the long run, saves much valuable time in servicing. The indications given by this tester are far more valuable than the characteristics of a vibrator found by checking with an oscillograph.

This vibrator tester determines the condition of a vibrator by checking its starting voltage. This indicates the quality of the vibrator on the basis of its starting characteristics just as a tube tester evaluates a tube from its cathode emission.

If the starting characteristics of a vibrator are good, a second check is provided which compares with the short test given a tube. This test is made by measuring the output voltage under load. A fairly constant, normal voltage indicates a good vibrator. If the output voltage is less than nine-tenths the normal voltage of a new vibrator of the same type or if it varies over a fairly wide range the vibrator should be discarded.

Vibrators passing both tests as indicated by this instrument may be used with confidence. Vibrators which are nearing the end of their lives are weeded out, thereby eliminating repeated trouble calls.

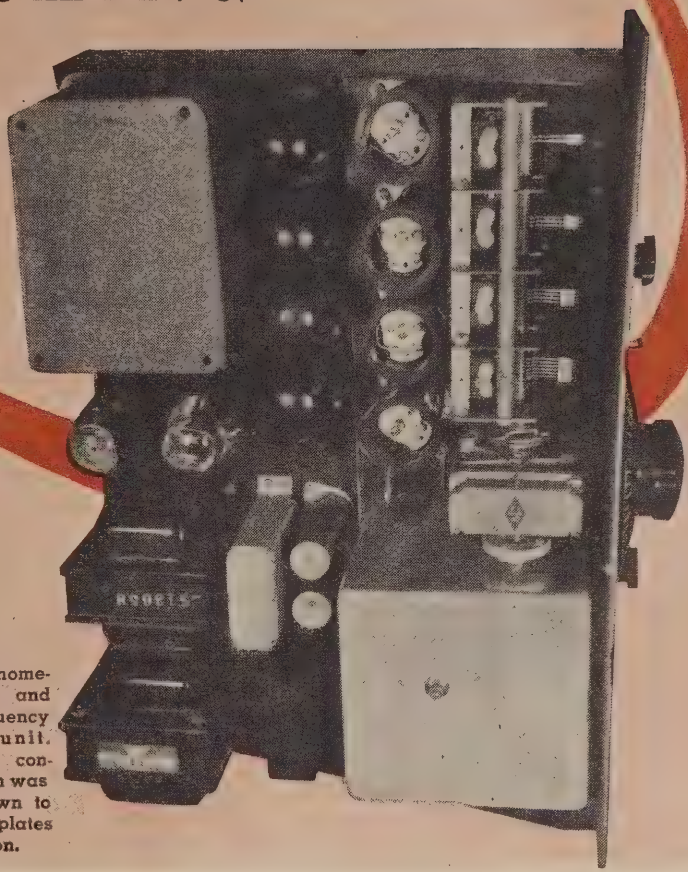
(*Continued on page* 146)

A BANDSWITCHING V.F.O. EXCITER

By

CARL HAYS, W6RTP

No plug-in coils required — a novel bandswitching arrangement provides 80, 40, 20, or 10 meter coverage.



Top view of home-built exciter and variable frequency oscillator unit. Variable condenser shown was later cut down to two rotor plates per section.

OF ALL those pieces of ham gear which the average amateur dreams about, perhaps none appears oftener in his "dream rig" than a completely self-contained exciter unit. The "dream" also includes a good, trouble-free variable frequency oscillator, frequency multipliers of reasonably husky output, link-coupling, of course, and over-sized power supplies—all of convenient size for table mounting.

Like everybody else, the author did little but dream about this exciter unit until finally this piece of equipment evolved from those dreams and became a reality.

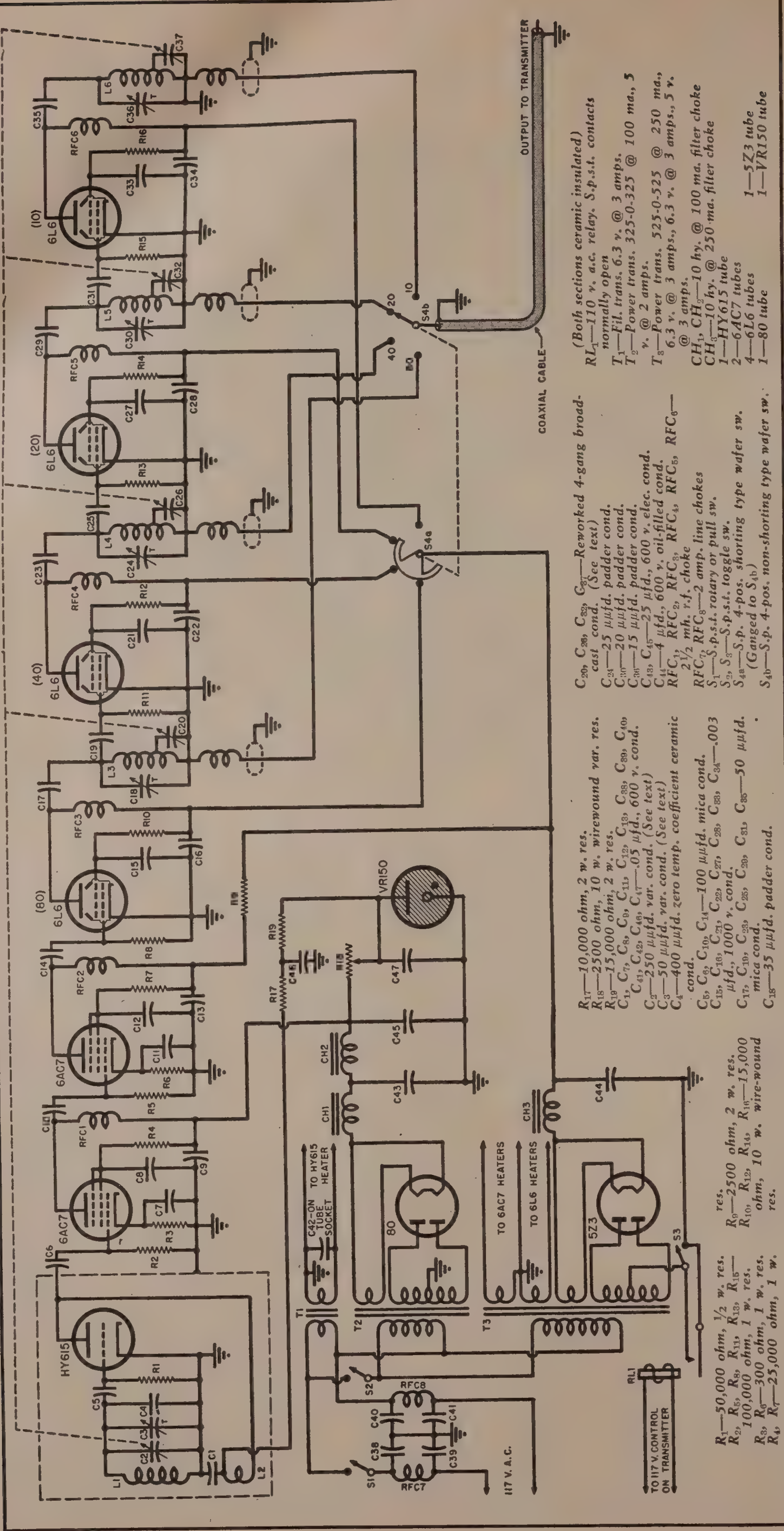
In designing this equipment there were several important requirements which had to be met. 1. An extremely stable v.f.o. with no r.f. feedback "bugs." The note of the oscillator to be as good as crystal—the drift, due to design and tube choice, to be nil. 2. The unit must be capable of being switched to any one of four bands with no power on the multipliers when not in use. 3. Power output, even on ten, must be sufficient to double the grid mils reading heretofore obtained from a commercial e.c.o. and built-in doublers in the rig, to the 829-B final. 4. It must have quickly adjustable link-coupling on all bands. 5. The entire unit including power supplies must be self-contained in a single receiver-sized cabinet and should be arranged for integral push-to-talk operation. In addition to the above attributes the unit as it finally evolved makes a fine c.w. exciter by using fixed bias and inserting a closed circuit keying jack in the cathode of the 80 meter doubler. Other attractive features which were incorporated in the final unit include grounded cathodes in all power stages and the use of two high-gain isolating "Class A" buffers. One useful item that contributes much to stability is the fact that the plate voltage is left on the oscillator and first "Class A" buffer during the time the unit is actually in operation. Very low oscillator voltage, plus real isolation and shielding, reduces the signal under standby conditions to such a low value that it cannot be heard once the unit is in the cabinet. With voltage on the two stages left on during receiving periods, the usual bugaboo of "warm up" is eliminated.

As can be seen from the diagram, the oscillator is somewhat unusual for this type of application as it is a fundamental, simple, and sure-fire tickler feedback Hartley. This circuit accomplishes several things advantageously, the most important being its absolute freedom from "hot cathode" ill effects, a feature not found in the electron coupled oscillator unless special precautions are taken since the cathode is grounded directly. Feedback adjustment is very simple, since all that is necessary is to subtract turns from a coil instead of fiddling with the critical cathode tap. This unit requires only fifty volts on the plate to perk nicely.

Several triodes were tried in this particular circuit but the HY615 was chosen for several reasons; among them was its very small interelectrode capacity which, if capacity change with heat occurs, results in a very small change in net capacity across the tuned circuit. In this case, for instance, there is a total of nearly 700 $\mu\mu$fd. in the tuning and fixed condenser combination to hit 160 meters. Thus it can be readily seen that if a capacity increase, with heat, of the HY615 elements does occur it must, of necessity, be a small percentage of the capacity used. In checking the *Handbook,* the interelement capacities of the HY615 will show that only a small change can occur in a tube having such small initial capacities.

The fact that the HY615 is expressly designed for oscillator use, that it will oscillate readily with very low voltage (and low heat), that its grid and plate caps are so located as to permit ideal physical layout, that it is a veritable powerhouse for its size, and that its filament draws such low current, serves to further emphasize the fitness of this tube in this application.

The next component which required special consideration was the oscillator coil. As has been pointed out many times before, bakelite is not a suitable material for an oscillator coil. The reason is simple as materials of this type have an unfavorable coefficient of



R_1—50,000 ohm, ½ w. res.
R_2, R_5, R_8, R_{11}, R_{13}, R_{15}—100,000 ohm, 1 w. res.
R_3, R_6—300 ohm, 1 w. res.
R_4, R_7—25,000 ohm, 1 w. res.
R_9—2500 ohm, 2 w. res.
R_{10}, R_{12}, R_{14}, R_{16}—15,000 ohm, 10 w. wire-wound res.
R_{17}—10,000 ohm, 2 w. res.
R_{18}—2500 ohm, 10 w. wirewound var. res.
R_{19}—15,000 ohm, 2 w. res.
C_1, C_7, C_8, C_9, C_{11}, C_{12}, C_{13}, C_{38}, C_{39}, C_{40}, C_{41}, C_{42}, C_{46}, C_{47}—.05 μfd., 600 v. cond.
C_2—250 μμfd. var. cond. (See text)
C_3—50 μμfd. var. cond. (See text)
C_4—400 μμfd. zero temp. coefficient ceramic cond.
C_5, C_6, C_{10}, C_{14}—100 μμfd. mica cond.
C_{15}, C_{16}, C_{21}, C_{22}, C_{27}, C_{28}, C_{33}, C_{34}—.003 μfd., 1000 v. cond.
C_{17}, C_{19}, C_{23}, C_{25}, C_{29}, C_{31}, C_{35}—50 μμfd. mica cond.
C_{18}—35 μμfd. padder cond.
C_{20}, C_{26}, C_{32}, C_{37}—Reworked 4-gang broadcast cond. (See text)
C_{24}—25 μμfd. padder cond.
C_{30}—20 μμfd. padder cond.
C_{36}—15 μμfd. padder cond.
C_{43}, C_{45}—25 μfd., 600 v. elec. cond.
C_{44}—4 μfd., 600 v. oil-filled cond.
RFC_1, RFC_2, RFC_3, RFC_4, RFC_5, RFC_6—2½ mh. r.f. choke
RFC_7, RFC_8—2 amp. line chokes
S_1—S.p.s.t. rotary or pull sw.
S_2, S_3—S.p.s.t. toggle sw.
S_{4a}—S.p. 4-pos. shorting type wafer sw. (Ganged to S_{4b})
S_{4b}—S.p. 4-pos. non-shorting type wafer sw. (Both sections ceramic insulated)
RL_1—110 v. a.c. relay. S.p.s.t. contacts normally open
T_1—Fil. trans. 6.3 v. @ 3 amps.
T_2—Power trans. 325-0-325 @ 100 ma., 5 v. @ 2 amps.
T_3—Power trans. 525-0-525 @ 250 ma., 6.3 v. @ 3 amps., 6.3 v. @ 3 amps., 5 v. @ 3 amps.
CH_1, CH_2—10 hy. @ 100 ma. filter choke
CH_3—10 hy. @ 250 ma. filter choke
1—HY615 tube
2—6AC7 tubes
4—6L6 tubes
1—80 tube
1—5Z3 tube
1—VR150 tube

←

Complete schematic diagram of v.f.o.—exciter unit. All output voltages are obtained by means of link-coupling. The oscillator is a conventional Hartley circuit.

expansion. Porcelain, isolantite and steatite forms, preferably one of the last two named, have, by comparison, almost perfect reaction to heat. In addition they allow a much higher "Q" to be obtained, are much more rigid, and are impervious to moisture. The use of a coil wound on such a form (grooved if possible) is almost mandatory for a really satisfactory oscillator.

The type of wire used is also highly important. It should be #18 enamel covered, of the solid variety, spacing to be the diameter of the wire. Before the wire is put on the form it should be stretched as much as possible then the wire and form should be heated in the oven. Using gloves, the coil should be wound as tightly and as rapidly as possible. When it is necessary to solder any connections to this coil use just enough heat to make a good joint without allowing the wire to lose any tension. This method, although used for years, is still good for trouble-free inductance.

Padding capacity may be obtained by using zero coefficient type ceramic condensers mounted rigidly close to the coil and tube. A small (50 μμfd.) rigid midget plate condenser is used as a trimmer and is mounted in the same manner as the ceramic condensers. It is of utmost importance that the tuning condenser be of first quality. It should have ceramic end plates, be of the double bearing type and have rigid, well spaced plates and be of the straight-line-capacity type. It should be mounted immovably on heavy L-shaped brackets front and rear. Be sure its rotor turns evenly but has a definite wiping contact to the ground lug. As an added precaution use one of the heavy, well-made, transmitting type flexible, ceramic-ring insulated shaft couplers to the dial drive unit.

This dial business is mighty important, for, to build a good oscillator and then try and tune it with a makeshift mechanism is the height of folly. One unit which is especially suited to the job is the *National* HRO-type. It is well built and has no backlash and, in addition, allows rigid, unyielding mounting to the heavy aluminum chassis plate on which all oscillator components must be mounted. In addition the unit requires no fastening to the panel, an important point from the standpoint of mechanical stability, even when a solid ⅛" heavily braced steel panel is used. On this particular unit the 80 meter band covers some 350 dial divisions which are approximately ¼" apart, on a circumference of about fifteen inches. This is equivalent to about nine or ten feet. It can readily be seen that no vernier scales or tricky wrist twisting are necessary to tune this exciter. In line with the coverage given for 80 meters, the unit covers some 100 divisions on 40 meters, 40 divisions on 20 meters, and 100 divisions on 10 meters.

In order to eliminate vibration in the unit, mount the oscillator and the first buffer stage on a sub-chassis of ¼" aluminum, spaced 1" above the main chassis by means of three rubber shock mounts yet leaving it free to float independent of any strain or shock reaching the chassis or panel. A hole, large enough to clear the shaft of the drive mechanism and located on the front panel, leaves the sub-chassis absolutely clear of any rigid connection—a requisite for stability from shock.

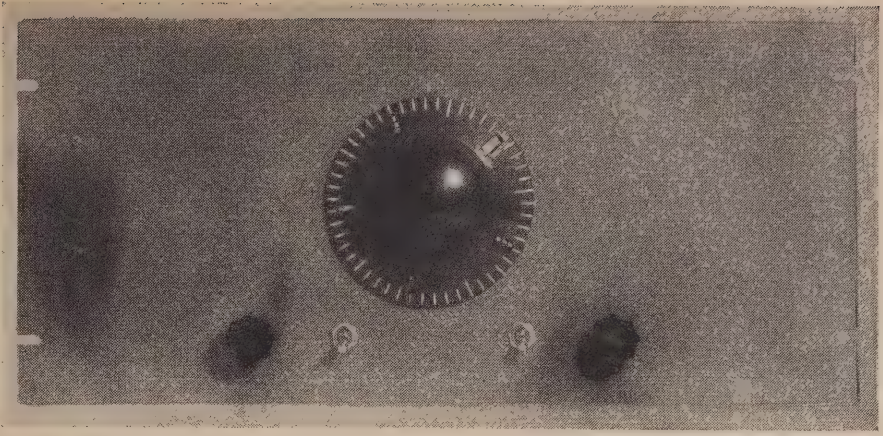
Circuit isolation from r.f. feedback, both internal and external, is shown in the photographs and diagram. Simple as it seems, it is highly important that such precautions be taken if trouble-free results are to be expected.

Shielding may be best accomplished by means of an aluminum or steel box which completely and rigidly encloses the oscillator section and is bolted to the sub-chassis. If desired, heat isolation can be improved by lining the inside of the box with a material such as ⅛" masonite. This procedure, however, is merely an added refinement and is not necessary to the operation of the unit.

Voltage stabilization is provided by a dropping resistor following the VR150 tube and puts an even 50 volts on the HY615. The filament of the oscillator tube is left on continuously as it draws little current and this procedure reduces the warm-up period.

The two isolating, high-gain 1852 (6AC7) stages following are self-explanatory and the only precaution which must be taken is that the first stage following the oscillator should be mounted on the sub-chassis, and its grid connections should be made rigid to minimize load changes reaching the frequency determining circuit.

The four 6L6 stages which follow, each with its own tank permanently tuned to the output band desired, are conventional except for the use of grid leak bias only and the parallel feed plate circuits. These were used because it made the direct grounding of the rotor of the four-gang condenser simpler. This condenser is an inexpensive one of the broadcast variety, cut down to two rotor plates per section and tapped across enough of each coil to allow tracking.



Single tuning control simplifies front panel layout. The controls from left to right are: oscillator filament switch, S_1; oscillator plate and filament voltage switch, S_2; doubler plate voltage switch, S_3; and bandswitch, S_4.

The switching circuit is a simple one. It allows only the stages in use to consume power. The switch is of the two section, ceramic wafer type and consists of a non-shorting section, single-pole, 4-position for the output links, ganged as a unit to a shorting type single-pole, 4-position section. This type of switching allows any one of the four bands to obtain excitation by simply placing it in the proper position—no other adjustment is necessary.

The relay obtains 110 volt a.c. from the push-to-talk mike circuit switch in the transmitter proper and enables the operator to throw the exciter-transmitter on the air with one operation. A single-pole, single-throw toggle switch, paralleled with the contacts of the relay, enables the unit to be placed in operation by itself for adjustment or frequency spotting in the receiver.

Two power supplies are shown on the schematic. The one for the oscillator and first "Class A" 1852 (6AC7) is one that was on hand—a husky 250 mil job using two sections, choke input, and 25 μfd. filters. (A transformer of 100 ma. rating would, however, handle the load). This means dependability plus, as well as excellent filter-

(*Continued on page* 183)

L_1—22 turns, #18 en., spaced wire diam., preferably on grooved ceramic 1¼" diam. form.

L_2—16 turns, #20 en. closewound ⅛" below grid coil (L_1). (See text for method of winding and mounting)

L_3—38 t., #20 en., 2" long, tap 6 t.*

L_4—20 t., #20 en., 1½" long, tap 5 t.*

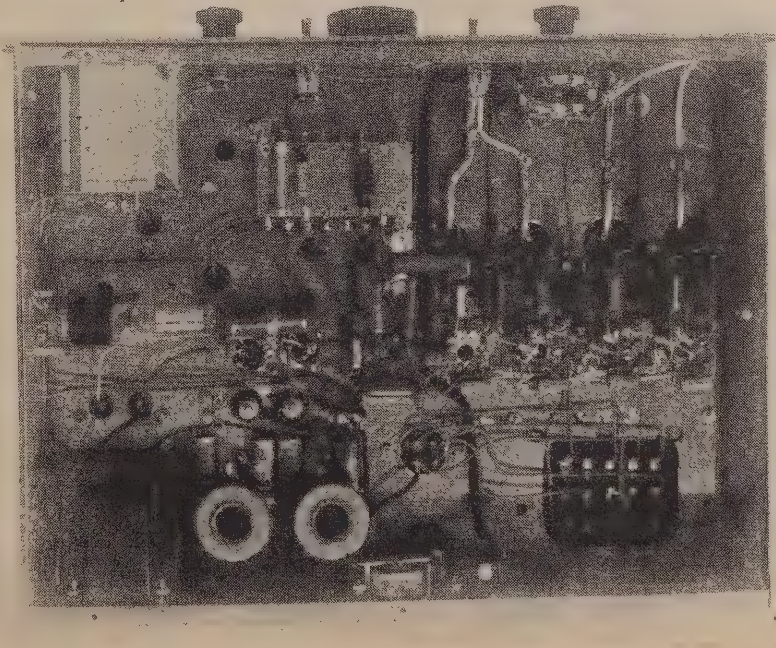
L_5—12 t., #20 en., 1¼" long, tap 3 t.*

L_6—6 t., #20 en., 1¼" long, tap 1½ t.*

** Wound on 1½" receiver type forms. 5-prong with padder mount. Taps shown are only approximate. Adjustment is necessary so that proper tracking is obtained for your particular unit. Link winding for L_3 to be 6 turns; L_4 to be 4 turns; L_5 to be 3 turns; L_6 to be 3 turns. All link windings to be ⅛" from cold end of coils. All link leads to be shielded to S_{4b}.*

Construction details for coil assemblies.

Under-chassis view of completed unit showing proper placement of parts.



TELEVISION COUNTERS

By
EDWARD M. NOLL

Theory of operation of several counter circuits used to produce horizontal and vertical sweep frequencies at the television transmitter.

IN THE sync generator of a television transmitter it is necessary to count down from the double line frequency of 31,500 to the field rate of 60 c.p.s. A block diagram of such a sync generator timing unit is shown in Fig. 2.

The basic timing circuit of the entire television system is a sine wave oscillator generally on 15,750 c.p.s. and, at times, on 31,500 c.p.s. In the generator of Fig. 2, the 15,750 cycle sine wave is doubled in frequency thus producing a 31,500 cycle sine wave. A 15,750 cycle output is taken from the timing unit at this point to synchronize all the horizontal circuits of the television system because the line repetition rate of the television system is 15,750 lines per second. The 31,500 cycle output excites a series of counter circuits which count down the double line frequency to the field frequency of 60 c.p.s. Therefore, the field timing is also a function of the basic 15,750 cycle oscillator. Two 60 cycle outputs are taken from the timing unit. One 60 cycle output synchronizes all the vertical deflection circuits of the television system while the second 60 cycle output is compared with the 60 cycles from the power line. If there is any phase displacement between the 60 cycle power line frequency and the final 60 cycle count down frequency, such as might occur when the basic timing oscillator departs from the correct frequency, a special discriminator circuit operates and restores the 15,750 cycle sine wave oscillator to its proper frequency. Consequently, the 15,750 cycle sine wave oscillator is the timing unit for the entire television system and is held precisely on frequency by proper comparison with the 60 cycles of the power mains.

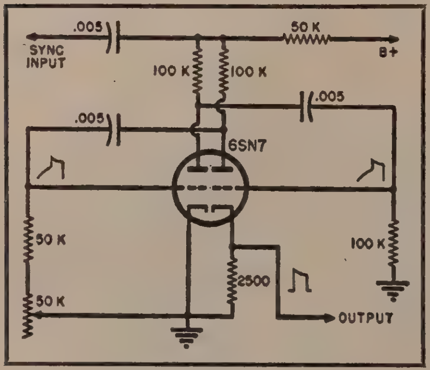
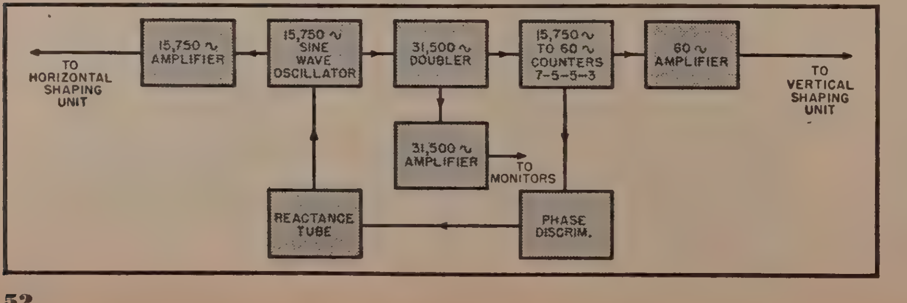


Fig. 1. Simple multivibrator counter.

The present commercial standard of television transmission is called the "odd-line interlaced system." This means that an odd number of lines are transmitted (525 lines per frame) and an even number of fields are transmitted. At the same time, the odd numbered lines are scanned in a first field and the even numbered lines are scanned in a second field completing one frame or one complete picture. Because of this odd-line, even-field arrangement it is first necessary to double the frequency of the line or horizontal oscillator before it is possible to count down to the 60 cycle field rate. Actually, the only means by which it is mathematically possible to control the field rate with the line rate oscillator is to first double the frequency of the line oscillator and then use a series of odd counters to count down to the field rate. In most television sync generators a series of four counters is used with ratios of 7, 5, 5, and 3. The product of these four terms is 525 or the number of lines per frame.

Fig. 2. Simplified block diagram of timing unit for television synchronizing generator.



Principles of Operation

A number of these counters were constructed as a series of laboratory experiments in the television classes at Temple University. The first counter constructed was of the basic multivibrator type discussed by Fink in his book *"Principles of Television Engineering."* Upon observation of the *RC* time constants of both grid circuits, the multivibrator at first appears to be symmetrical. However, whenever the potentiometer in the grid section of the first section is not on maximum, the multivibrator becomes nonsymmetrical as it must be to operate as an odd-numbered counter. When the potentiometer is on maximum the multivibrator operates symmetrically. When the multivibrator is operated symmetrically the grid discharge and waveforms are identical. See Fig. 4. The output of the multivibrator is a pulsed waveform which appears across the cathode resistor of the second section.

Synchronizing signals from the preceding counter or oscillator are fed to both plates of the multivibrator and appear across the common plate resistor shown in Fig. 1. Consequently, both grids of the multivibrator are synchronized by synchronizing pulses or signals. Thus, if a series of negative sync pulses is applied to the multivibrator (as showed in Fig. 4) grid No. 1 is synchronized on the No. 5 pulse and grid No. 2 is synchronized on the No. 9 pulse. This, however, does not mean that the multivibrator is operating as a four-to-one counter because output is taken off of only one cathode circuit. Note that the only time any output is obtained is when the No. 1 pulse or the No. 9 pulse is synchronizing the second section of the multivibrator or driving the second section into conduction. Thus, the multivibrator is, in reality, an eight-to-one counter which is synchronized on every fourth pulse to improve stability. Inasmuch as the multivibrator must operate as an odd numbered counter it is necessary to reduce the time constant of the first section grid circuit. To do this, the resistance from the grid to ground of the first section is reduced with the potentiometer. The effects of the reduction in the grid time constant can be seen in the lower section of Fig. 4. Note that the first section synchronizes on the No. 4 pulse while the second section synchronizes on the No. 8 pulse. Again both grids are synchronized but the result is now a seven-to-one counter because the only time output is taken from the multivibrator is at the instant the first and eighth pulses drive the second section into conduction.

It is also possible to use sine waves as the driving signal for this counter. In the actual experiment a beat frequency audio oscillator was used as the source of driving signal. The multivibrator and frequency of the audio oscillator were adjusted until the first section grid synchronizes on the third sine wave while the second section grid synchronized on the seventh sine wave to produce the waveforms indicated in Fig. 5. This type of counter occasionally jumps synchronism or counts when there are fluctuations in line voltage or changes in tube characteristics.

A more stable and more elaborate counter is shown in Fig. 3. This is a step counter and uses two diodes and two condensers to build up a step voltage on one of the condensers, which then triggers the multivibrator. The stepping counter consists of two charging diodes which step charge condenser C_2, a trigger tube which is driven into conduction when the amplitude of the step voltage reaches a certain level, and a screen grid multivibrator circuit which is triggered whenever the triggering tube is driven to conduction. When an incoming square or sine wave is applied to the charging diodes through condenser C_1, the positive going portion of the signal drives tube V_2 to conduction. When diode V_2 is conducting it causes a charge to appear across condenser C_2. The amplitude of this charge is a function of the capacity ratio of C_2 to C_1. This ratio is usually twenty-to-one and consequently one-twentieth of the total voltage appears across C_2. On the negative sweep of the signal the second diode, V_1, conducts and the charge is completely removed from condenser C_1. This action of the diode V_1 is similar to a d.c. restorer or clamp which returns the condenser to a no-charge level between pulses. During the negative part of the cycle however, diode V_2 does not conduct and the charge remains on condenser C_2 because it has no discharge path.

On the next positive alternation diode V_1 cuts off and diode V_2 conducts adding another charge or step to condenser C_2. Again, on the negative alternation diode V_1 conducts and discharges C_1 while the charge remains on condenser C_2. Thus, each new positive alternation adds a charge to condenser C_2 building up the voltage in a series of steps (Fig. 7) until a voltage level is reached which has sufficient amplitude to overcome the trigger tube cathode bias causing it to conduct. It should be noted that each step charge is of slightly less amplitude than the previous one because the charge condenser attempts to charge up to peak value of the applied pulse exponentially. Or, to consider this same condition in another way, the differential between peak pulse amplitude and condenser C_2 charge level becomes progressively less as the charge builds up on C_2. Thus the voltage split between C_1 and C_2 is still the same but there is less voltage to be divided. This means that there is a practical limit to the steps or count that can be obtained because there is greater opportunity for instability and incorrect firing as the step levels approach each other in amplitude. A seven-to-one count is about the maximum which can be achieved when this type of counter is used for television.

When this step voltage reaches a sufficient level to cause the trigger tube to conduct, the drop in trigger tube plate voltage drops the screen grid (acts as the plate of the triode multivibrator) voltage of the first section and control grid voltage of the second section. This, in turn, raises the plate voltage of the second section and applies an amplified burst of voltage to the first section control grid which drives the first section into conduction each time the trigger tube conducts. Inasmuch as the tube only conducts when the voltage reaches the proper level, the circuit operates as a counter.

The time constant of the first section of the multivibrator is short in comparison to that of the second section, thus the second section conducts for a greater portion of the multivibrator cycle, the first section conduct-

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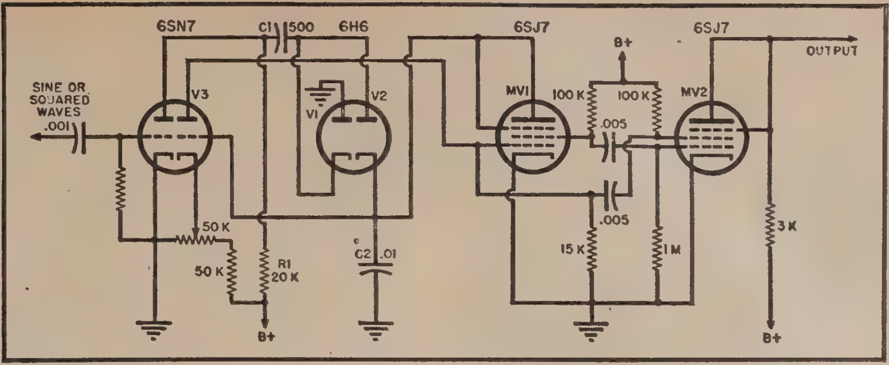


Fig. 3. Schematic diagram of multivibrator type step counter.

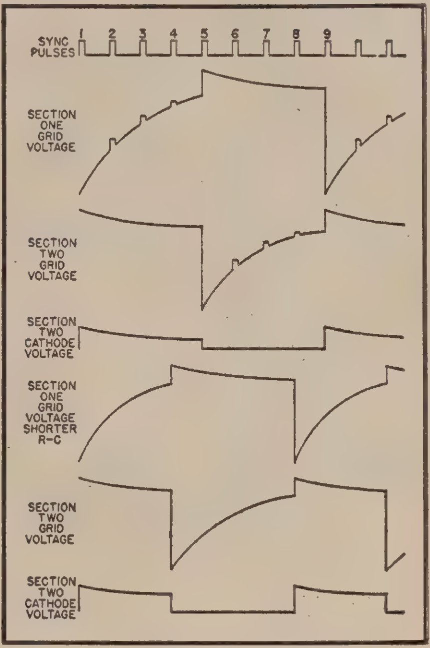


Fig. 4. Multivibrator waveforms.

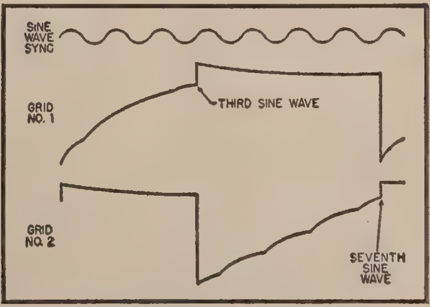
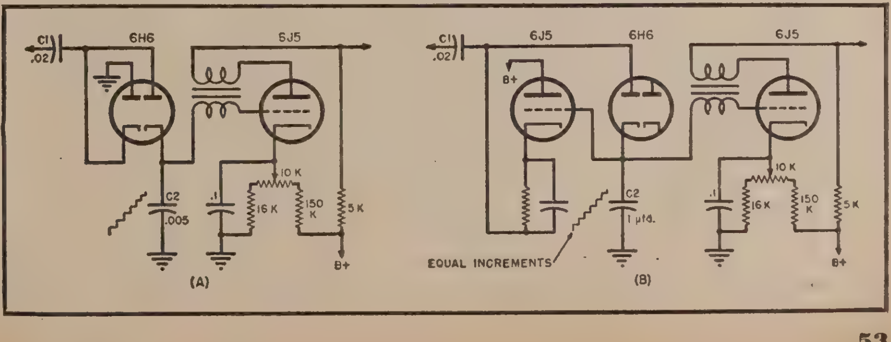


Fig. 5. Sine wave, from an audio oscillator, being used as the driving signal for counter.

Fig. 6 (A). Blocking tube counter, (B) blocking tube counter with equal voltage steps.



Reflective Optical System for PROJECTION TELEVISION

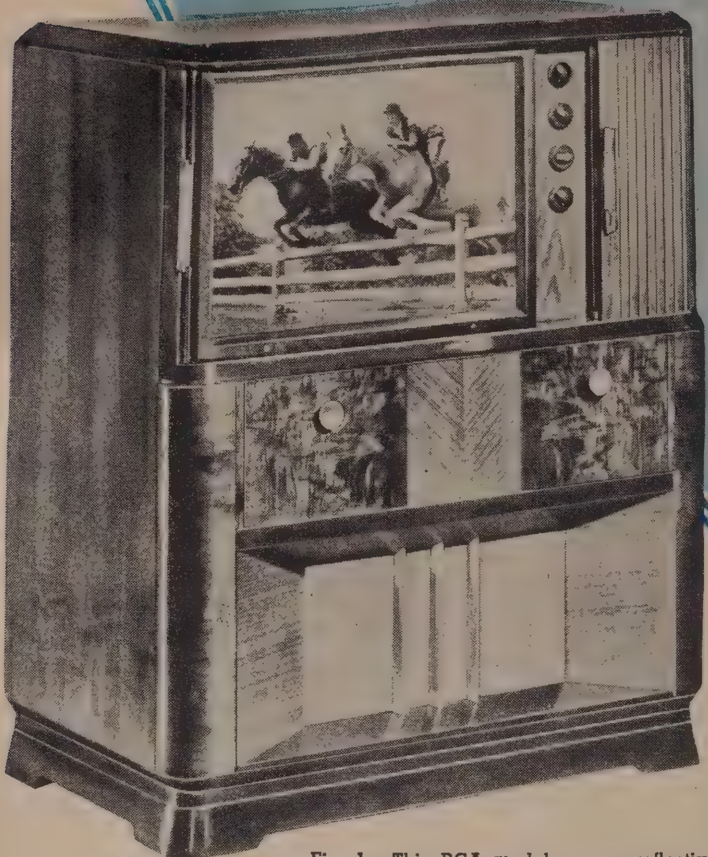


Fig. 1. This RCA model uses a reflective optical system with a 5TP4 kinescope to produce a final picture size of 15x20 inches.

By
Dr. V. K. Zworykin

Vice-President and Technical Consultant,
RCA Laboratories

Few men have been more closely associated with the science of electron optics and the development of television than Dr. Vladimir K. Zworykin.

Inventor of the iconoscope, kinescope, and countless other electronic devices, Dr. Zworykin is an outstanding authority on television optics, cameras, and tubes.

He is responsible for the development of the Radio Corporation of America's all-electronic television system.

Noted scientist describes new optical system for large screen television.

AN IMPORTANT requirement of many of the larger types of modern television receivers is the projection of magnified picture images on a suitable, large observation screen.

This method of picture display is known as large-screen or projection television. It is an important and immediate step forward in television progress, since it is a simple and relatively inexpensive optical arrangement that provides enlargement and extension of picture images—for viewing at greater distances from the receiver without eyestrain, and for viewing by a greater *number* of people, than would otherwise be possible with a direct-viewing television set. Currently, there is a pronounced trend among many set buyers toward large-screen projection of television picture images.

Enlargement and projection of television pictures requires the use of a simple but highly effective optical system, a special kinescope or picture tube, and minor considerations of cabinet design and optical adjustment. In operation, the final image is first formed on the screen of the picture tube and is then magnified optically and projected onto a large, upright viewing screen.

It was inevitable that research and development in the field of television reception eventually should encompass the science of optics—since television, itself, is a *visual* instrument with electron-optic components. However, only a few optical arrangements or systems can be used, because of the stringent requirements imposed by the nature of television projection.

The simplest, most effective, and efficient means of image projection is a system which employs optical reflection by means of a spherical mirror.

This reflective optical system can be adapted for use in home television receivers having *any* size of large viewing screen. Also, it forms the basis for extremely large-screen projection used in theater television. *Basically,* the same optical system may be used for projecting chromatic television pictures.

Use of the System

A typical home receiver equipped with large-screen television (Fig. 1) is the *RCA* projection-type television-radio console. The complement of 48 tubes in the complete set, which also provides AM, FM, and short-wave reception, includes a new type of picture tube—the type 5TP4—known as a projection kinescope.

The size of the final picture image on the large screen is roughly 15 inches by 20 inches, or about *six times* the size of the image on the face of the 5-inch picture tube. Focusing, magnification, and projection are accomplished by the reflective optical system consisting of a spherical reflecting mirror, an aspherical correcting lens, and a plane mirror set at an angle of 45 degrees to direct the final image onto the viewing screen. This arrangement is shown in Fig. 4.

The enlarged, final image on the observation screen must be sufficiently bright for satisfactory viewing in a well-lighted room. Since all light elements are reflected onto the screen from the kinescope, the brightness of the final picture image is a function of the image brilliance on the face of the kinescope. Exceptional brilliancy is easily obtained, because the tube is especially designed for projection operation. The inside face of the tube screen is coated with an improved phosphor compound, and over this layer is placed a thin electron-transparent but light-reflecting metallic film which permits a high accelerating voltage for the electron beam. To achieve this, the second anode of the projection kinescope is operated with a potential of 27,000 volts, causing the extremely intense beam of electrons to strike the screen with great force—providing an image brilliance of great magnitude. All images appearing on the face of the kinescope are projected by the optical reflecting system to the back of the translucent, plastic, viewing screen.

The light-gathering ability of this optical system makes it possible to transfer to the viewing screen a high percentage of the image light produced on the face of the kinescope, whereas the efficiency of a conventional projection *lens* system in such an application is extremely low. A more complete understanding of the optical function of the basic reflecting system requires consideration of a few laws of the science of optics.

About Optics

Light is a form of radiation. Light waves or rays are similar to radio waves, except that the frequencies of light are very much higher and confined to a narrow band of frequencies. The eye can detect or see light waves within this narrow band, but is unaffected by higher or lower frequencies.

Also similar to short radio waves, light rays are propagated in straight lines—and their paths depend only on their point of origin and initial direction.

A ray of light *incident* on a mirror is *reflected* at the same angle with the surface as the incident ray. A ray of light passing through a transparent medium (such as glass or clear plastic) is *refracted* or deflected obliquely from its path according to the nature (the refractive index) of the medium. A light ray is said to be reflected when it is sent back into the medium (air, glass, etc.) from which it came. However, *no* surface obtainable reflects all of the light rays falling upon it. Highly polished silver has a reflectivity of about 91 per-cent, aluminum about 88 per-cent, and gold about 70 per-cent; these are a few of the best reflecting surfaces.

One important *shape* of reflecting surface is a concave *spherical mirror*, shown in cross section (Fig. 2), and having a highly reflective metallic coating on the inner surface. The segment *AOB* is the arc of a circle, of which the center *C* is known as the *center of curvature*. The chord *AB* is the *aperture* of the mirror. The distance *DO* is the *focal length* of the spherical mirror, and is equal to half the radius of the curvature of the sphere. The point *D* is known as the *principal focus*.

If a point source of light is located at the principal focus of a spherical mirror having a relatively small aperture (Fig. 2), all light rays incident on the mirror surface will be reflected in directions parallel to the principal axis of the mirror. Any *object* located on the principal axis between the center of curvature *C* and the principal focus *D* will be reflected by the mirror as an enlarged, inverted *image*.

Use of a spherical mirror with a large aperture produces poor focusing and resulting distortion. If a small, limiting aperture is located at the center of curvature *C*, the focusing action of the system is very good, except that a flat object is reflected as a curved image. To obtain a flat image (or image which can be viewed on a flat screen, without distortion), it is necessary to use a curved object, such as the face of a cathode ray tube. The radius of the object is about equal to one-half the radius *CO* of the reflecting mirror, so that portions of the two spheres facing each other will be approximately concentric. This arrangement is shown in cross section in Fig. 5.

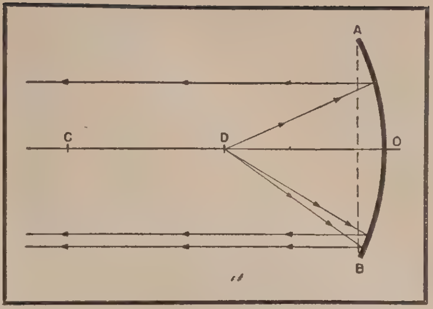
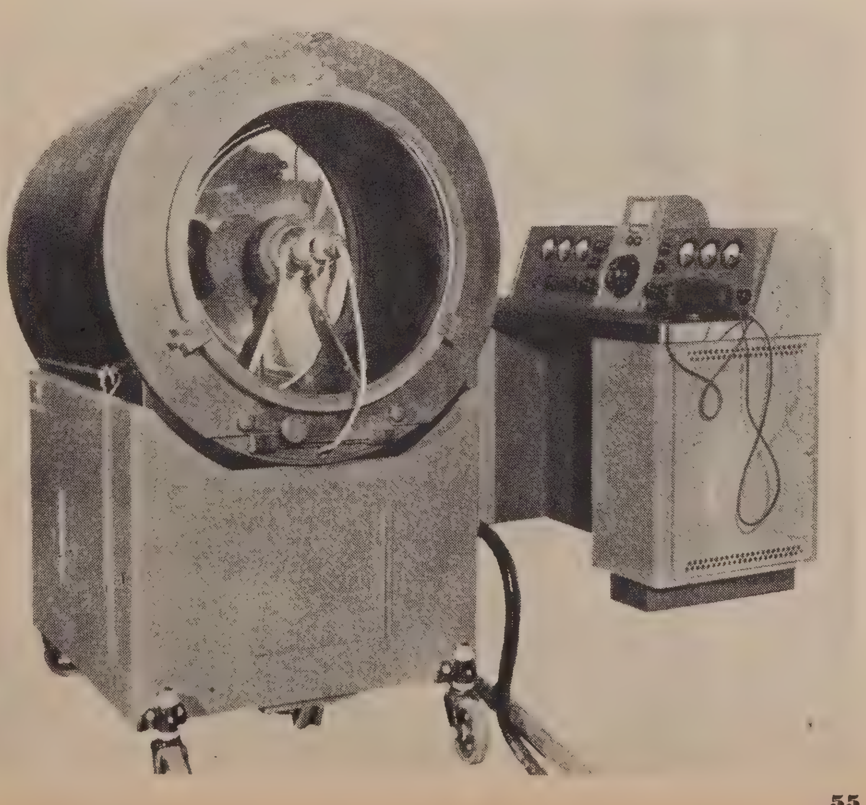


Fig. 2. Reflection of light from a point source by a simple spherical mirror.

Light rays originating from any point on the surface of the object (the face of the picture tube) are reflected by the spherical mirror, and then converge at various focus points, all of which lie in a plane at right angles to the principal axis of the system. This plane surface represents the observation or viewing screen. When a picture image appears on the fluorescent screen or face of the picture tube, it is reflected and focused by the spherical mirror (Fig. 5) so that the image appears greatly enlarged and inverted on the large plane surface of the viewing screen.

Trace this optical action in terms of individual light rays, referring to Fig. 5. Light rays 1 and 4 represent the approximate limits of both kinescope and final-screen image, in the plane of the drawing. Ray 2 contributes a small amount of light to another part of the reflected image. Ray 3 originates at the center of the kinescope fluorescent screen and by optical reflection reaches the center of the plastic observation screen. Countless

Fig. 3. Projector for theater television with control console in the background.



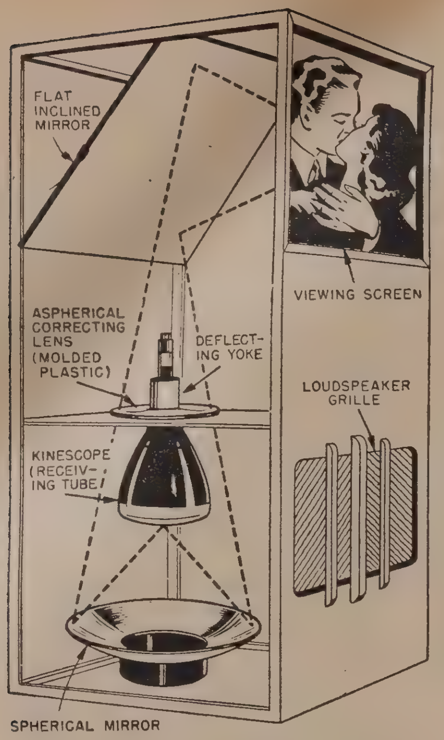


Fig. 4. Large screen television for the home provides bright, high definition pictures on a screen 20x15 inches by means of a reflective optical system.

other rays follow other paths, reaching the viewing screen at points proportionally located with respect to points of origin (the kinescope face). The total or combined effect of all light rays emanating from the picture tube produces a complete, enlarged, and inverted image of the original object.

Considerable improvement in the efficiency of an optical system can be accomplished by enlarging the size of the limiting aperture. An enlargement of the aperture, however, produces a distorted and poorly defined picture image. This is caused by the *spherical aberration* of the reflecting mirror, known as a characteristic error of the optical component.

Aberration

The effect of spherical aberration is uniform over the entire projected field of the image; it is present at the edges as well as the center of the picture image on the viewing screen.

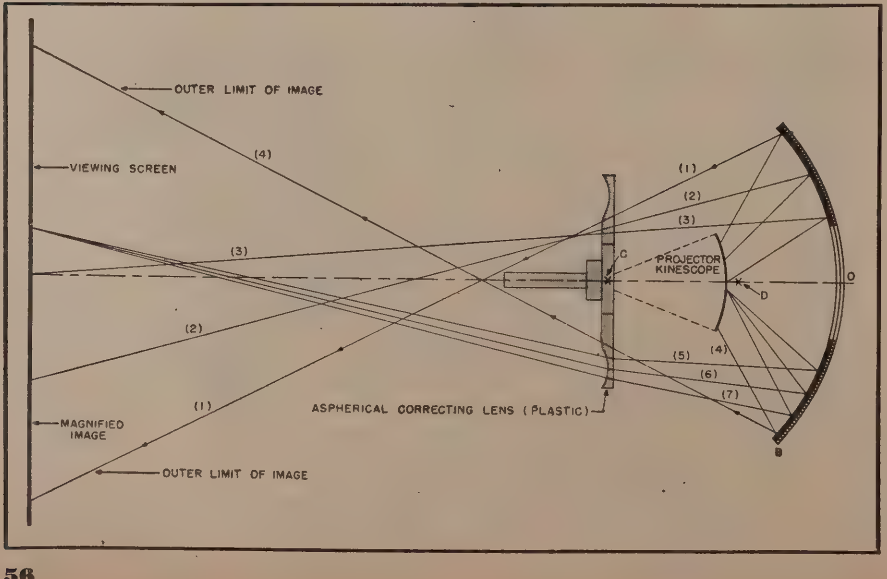
This error is inherent in the mirror itself. Since the nature of the error is known, it may be counteracted or eliminated entirely by introducing into the optical system another optical component—such as a *lens*—having the opposite error. In this way, one lens or mirror complements the other. Light rays pass through both optical components, and the final image is effectively free of distortion.

An aspherical correcting lens is introduced to the optical system, for this reason. It compensates for natural errors of the spherical mirror, thus insuring clear and well-defined picture images on the final viewing screen.

Typical use of the correcting lens is shown in Fig. 5. Size of the lens is large in order to increase the efficiency of the system and to provide good picture definition. The lens is very weak, and located at the *center of curvature* of the mirror so that the symmetry of the optical system is least disturbed.

Shape of the lens is important, since it controls the amount and type of correction. The shape is such that all light rays emanating from any point on the inner face of the kinescope will, after reflection, be *optically* forced to converge at a single point on the viewing screen. This action is illustrated in Fig. 5 by light rays 5, 6, and 7, all of which originate at the same point on the face of the picture tube, take different paths during reflection, but converge at a point on the viewing screen *due to the correcting action of the aspherical lens.*

Fig. 5. Optical reflection of light from a television picture tube by a spherical mirror and a correcting lens. The image appears greatly enlarged on viewing screen.



Preparing and polishing a *glass* correcting lens of such unusual shape would be difficult, costly, and time consuming. This difficult problem of construction has been overcome, however, by processing the lens from heated plastic formed in precision molds while under high pressure. Optical properties of plastic are superior to glass and, in addition, there is considerably less scattering and even higher transmission of light rays.

Production-line manufacture of these lenses is so precise that *no* polishing, surfacing, or finishing is required before insertion in the reflective optical system.

Although reflecting mirrors are easily manufactured of glass because of their simple shape, future mirrors probably will also be constructed of molded plastic.

The Picture Tube

A special type of *projection* kinescope has been developed for use in this and all similar reflective optical systems for large-screen television.

To provide sufficient light for reflection, the picture tube is required to operate with extreme brilliancy which, in turn, requires a high acceleration voltage for the electron beam.

During development, the use of a high potential was found incompatible with other essential factors, until several problems were solved.

One such problem was the effect of high-voltage electron bombardment on the phosphors used to coat the fluorescent screen of the kinescope. It proved necessary to place a thin, metallic film over the phosphor compound, permitting the luminescent material to give long and stable service under greater electron bombardment. The important technique of coating the phosphor layer with a thin, electron-transparent, light-reflecting, metallic film (usually aluminum) permits much higher operating voltages than were formerly possible. The metallic film acts somewhat as a mirror, preventing loss of light within the tube. This important technique considerably enhances the brightness and the contrast of the screen image of the kinescope.

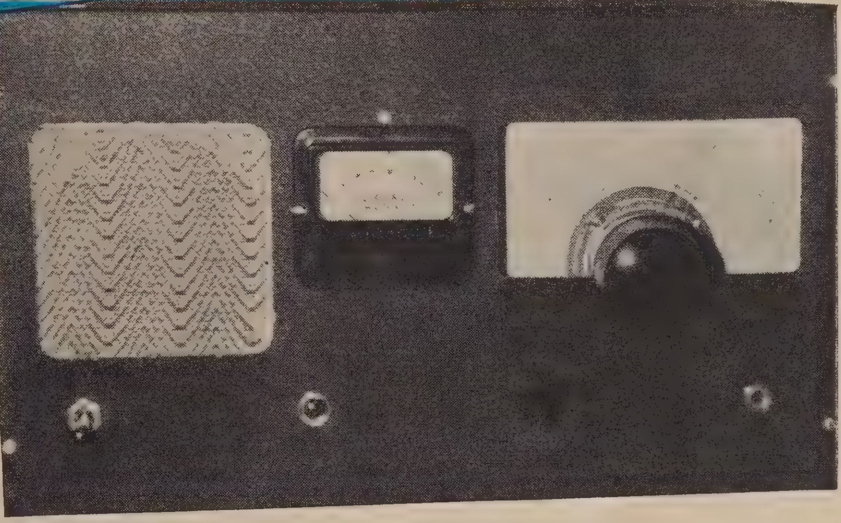
Another development problem was the tendency of high voltages to cause a potential breakdown between electrodes within the picture tube. This was overcome by increasing the space between adjacent electrodes, by evacuating the tube to a very high vacuum before sealing, and by polishing all parts and protuberances which might serve as terminals for potential current arcs.

There was also the problem of reconciling high current with a sharp focus for the electron beam, since the difficulty of obtaining a good focus increases rapidly with an increase in current. This problem was overcome by improvements in the design of the electron gun used in the kinescope.

(*Continued on page* 153)

Designing a 2 METER COMMUNICATION RECEIVER

Front panel view of home-built receiver.



This 144-148 mc. superheterodyne features good selectivity, an "S" meter, and noise limiter.

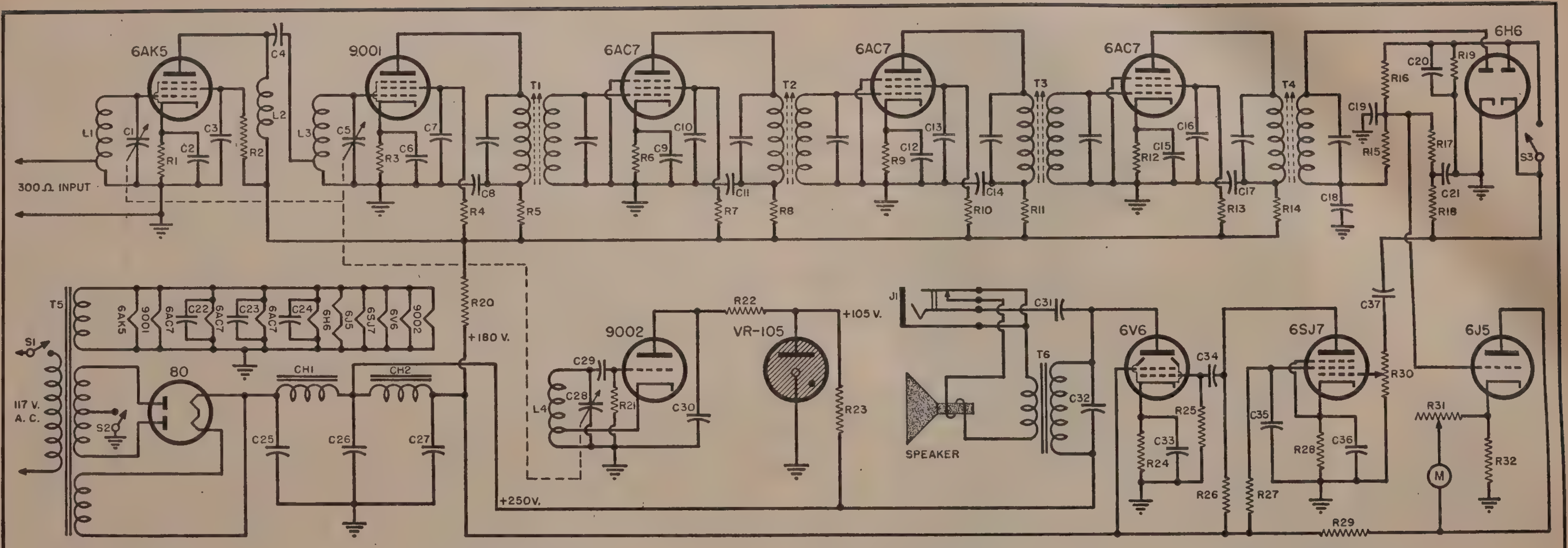
By
ROBERT B. TOMER, W1PIM
Chief Eng., Symphonic Radio & Electronic Co.

SOME time in the early part of last year the QRM situation on 2 meters in the Greater Boston area became so bad on occasions that there was nothing to do but pull the switch and go to bed. Particularly was this the case during one of those evenings when the second and third district stations were being heard and everybody was either listening or calling on their frequencies. The receiver in use at that time was a typical 955 superregen which had been carefully designed and improved until very little more could be expected from it, yet it left much to be desired. It was, of course, noisy like all members of the superregen family. In addition, one or two local stations or receivers would just about completely block the whole band and make any further operation impossible. The receiver had plenty of sensitivity and aided by a six element beam, there wasn't much that it wouldn't hear, provided no other locals were on or listening at the same time.

The obvious answer was to attempt to design some sort of receiver that would overcome the weaknesses inherent in the superregen and at the same time sacrifice none of the sensitivity. To design such a receiver is no small undertaking because the sensitivity of the superregen detector is little short of miraculous. Almost any homemade receiver of this type will have a sensitivity of 1 microvolt and a good one can easily measure .25 microvolt. When one considers the fact that a good broadcast receiver with six or eight tubes will seldom measure better than 25 microvolts and the better grade of communications receivers rarely go below 1 microvolt with up to twelve tubes, the problem of building a receiver for 144-148 megacycles with a sensitivity of better than .25 microvolt becomes all too apparent.

It appeared that either a combination superhet-superregen or a multitube superhet would be required to do the job. The former system seemed the simplest answer and so a set was built using a single tube, a 6J6, as the oscillator and mixer and this worked directly into the superregen second detector on 12 megacycles. This arrangement proved very difficult to handle due to interaction between the oscillator and mixer circuits in the same tube. "Pulling" of one circuit by the other made tracking impossible. Reducing the oscillator amplitude to a point just before it stalled seemed to help reduce the pulling and permitted some degree of tracking, however, the sensitivity was poor compared to the original superregen and so the idea was discarded. A separate oscillator and mixer tube was next tried, using a 9001 as mixer and a 9002 as oscillator. In addition, one stage of i.f. amplification was added ahead of the second detector using a 6AC7. This arrangement showed real progress. Tracking and ganging became quite simple and stable, the addition of the i.f. stage brought the gain up considerably and the action of the second detector seemed to become smoother. Considerable difficulty was encountered coupling the plate of the 6AC7 to the grid circuit of the superregen detector. Inductive coupling was tried first, using a tuned plate circuit coupled to the tuned grid circuit. It was found, however, that when the plate circuit was brought to resonance with the grid circuit the detector would go out of superregeneration. Decoupling was attempted, but it turned out that when the coils were sufficiently decoupled to prevent blocking of the detector there was insufficient coupling to provide any signal. Many different types of i.f. transformers were made and tried, but all had the same difficulty. Finally, choke and capacity coupling were resorted to which sacrificed some gain and selectivity, but otherwise worked very satisfactorily. The receiver as a whole, however, did not measure up well in comparison with the old superregen and so an r.f. stage was added ahead of the mixer stage. Getting this to work correctly was a project in itself, but more about that later. The addition of the r.f. stage accomplished something, but it was still not a good enough receiver to have warranted the time and effort thus far spent on it. Another stage of i.f. was decided upon, using another 6AC7 and subsequently it was built into the receiver. With the addition of this extra stage, the gain of the receiver went way up, but at the same time, the noise level seemed to rise disproportionately. A good deal of thought and study went into trying to find the cause for this increase in signal-to-noise ratio and the explanation seemed to be as follows.

Whenever an amplifier is placed ahead of a superregen detector operating at the same frequency as that of the detector, this condition seems to become apparent. It is well known



R_1—250 ohm, ½ w. res.
R_2—25,000 ohm, ½ w. res.
R_3, R_{21}, R_{22}—10,000 ohm, ½ w. res.
R_4, R_{17}, R_{27}—1 megohm, ½ w. res.
R_5, R_8, R_{11}, R_{14}—1000 ohm, ½ w. res.
R_6, R_9, R_{12}—100 ohm, ½ w. res.
R_7, R_{10}, R_{13}, R_{15}—50,000 ohm, ½ w. res.
R_{16}, R_{19}, R_{26}—250,000 ohm, ½ w. res.
R_{18}—820,000 ohm, ½ w. res.
R_{20}—2000 ohm, 5 w. res.
R_{23}—5000 ohm, 25 w. res.
R_{24}—300 ohm, 1 w. res.
R_{25}—500,000 ohm, ½ w. res.
R_{28}—1500 ohm, ½ w. res.
R_{29}—10,000 ohm, 1 w. res.
R_{30}—500,000 ohm pot.
R_{31}—5000 ohm, 5 w. rheostat
R_{32}—750 ohm, ½ w. res.
C_1, C_5, C_{28}—15 μμfd., 3-gang var. cond. one stator plate removed, double spaced
C_2, C_3, C_6, C_7, C_8, C_{30}—500 μμfd., low-loss mica cond.
C_4—50 μμfd. ceramic cond.
C_9, C_{10}, C_{11}, C_{12}, C_{13}, C_{14}, C_{15}, C_{16}, C_{17}—.005 μfd., 600 v. cond.
C_{18}, C_{19}, C_{20}, C_{29}—100 μμfd., low-loss mica cond.
C_{21}—.05 μfd., 400 v. cond.
C_{22}, C_{23}, C_{24}, C_{31}, C_{32}, C_{34}—.01 μfd., 400 v. cond.
C_{25}, C_{26}, C_{27}—10 μfd., 450 v. elec. cond.
C_{33}, C_{36}—10 μfd., 25 v. elec. cond.
C_{35}—.1 μfd., 400 v. cond.
C_{37}—.02 μfd., 400 v. cond.
L_1, L_3—4 t. #11 copper wire, ⅜" i.d. spaced wire diam.
L_2—45 t. #28 en. wire, $^3/_{16}$" i.d. closewound
L_4—Same as L_1, tapped one turn from bottom
T_1, T_2, T_3, T_4—See text
T_5—Power trans. 350-0-350 @ 120 ma.; 5 v. @ 2 amps.; 6.3 v. @ 3.5 amps.
T_6—Output trans. 5000 ohm pri.-to-v.c.
S_1—S.p.s.t. sw. on R_{30}
S_2, S_3—S.p.s.t. toggle sw.
CH_1, CH_2—10 hy., 110 ma., 225 ohm filter choke
J_1—Circuit opening headphone jack
Speaker—PM type speaker
M—0-1 ma. d.c. meter
1—6AK5 tube
1—9001 tube 1—6J5 tube 1—VR-105 tube
3—6AC7 tubes 1—6SJ7 tube 1—9002 tube
1—6H6 tube 1—6V6 tube 1—80 tube

that the superregen detector radiates a signal which is modulated by the quench frequency but it seems not to be so well established that it is also modulated by the characteristic rushing sound which comes out of the speaker of such a receiver. As a matter of fact, it also seems to be modulated by any other signal that happens to be present in its grid circuit at the time. Thus, it can re-radiate the same signal to which it is tuned, on many different frequencies, all close to its own fundamental. This effect is very noticeable on a superhet with a diode second detector. When a superregen receiver is tuned across its frequency, a loud hissing sound will come from the superhet. This noise is exactly the same as that normally coming from the superregen receiver. In addition, if you happen to be located near to one of those powerful radiating detectors, such as an HY-615, you will be able to tell what station they are receiving by simply tuning across the band until you hear the hissing sound, and then, by tuning around in the hiss, you will find the same signal at what seems to be several different frequencies over an area of perhaps one half a megacycle. This is evidence enough that both the noise and the signal do radiate from the detector. It is logical to assume, therefore, that a portion of this radiation can re-enter the amplifier stage and be fed through again, perhaps out-of-phase, so that it is presented to the detector again as any other signal would be. It is also recognized that the superregen detector sensitivity goes down under signal input and that a sort of a.v.c. action takes place. Consquently, the result of receiving a portion of its own hash is that the detector sensitivity drops off and the noise, which is really the modulation on the signal being received, gets louder.

To prove the correctness of this theory, the second detector was completely shielded in a separate box under the chassis. All leads entering this box were completely filtered so that no energy could radiate from the detector. This device made a great improvement in the receiver. The noise level went down to where it should have been and the stability of the i.f. system improved at the same time. The resulting receiver was beginning to act like a pretty good set. The gain was somewhat better than the original receiver, selectivity was very much better, but the noise was still rather high and the quality of the second detector was not all that could be desired. In the course of experiments with the second de-

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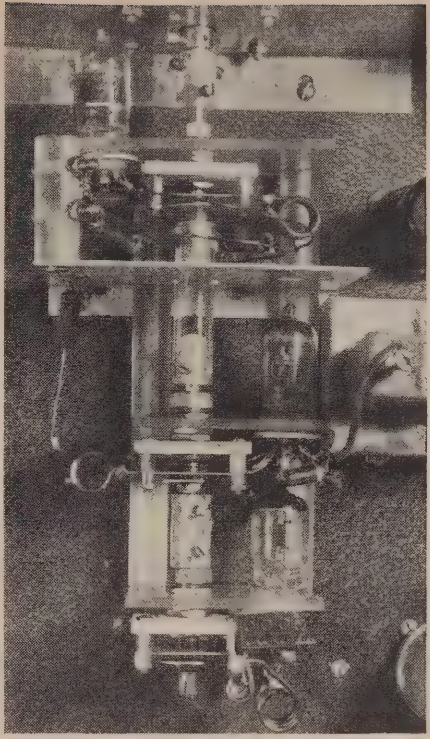
Schematic diagram of complete 12-tube (including rectifier and voltage regulator tubes) receiver. The circuit is straightforward with the exception of the oscillator stage. Note that there is no direct coupling between the oscillator and mixer stages. Inductive coupling is depended upon for injection of oscillator voltage. Placement of component parts is semi-critical. The author's original layout should be followed as closely as possible in order to duplicate performance.

tector circuit values, it was discovered that under one set of conditions, the detector would go out of superregeneration almost imperceptibly, the only noticeable change being the loss of noise. Under this condition of straight regeneration, it performed perfectly quietly and signals came in as on a broadcast receiver. The gain of the detector was reduced in this condition, but the signal-to-noise ratio was so far improved that the effective sensitivity was actually better. There was just one drawback to this type of operation and that was the large amount of ignition noise which came in as soon as the detector went out of superregeneration and into regeneration. Several types of audio noise limiting circuits were tried but without any real success. As a final attempt to clean up the ignition noise, a diode second detector was tried with an automatic series valve noise limiter. Another stage of i.f. was necessary to offset the loss in gain by not using the regenerative second detector. The resulting receiver was so satisfactory in every way that it was adopted as the final design and plans were drawn up to rebuild it into its present form. What had seemed at first consideration to be the more complicated way out proved to be the easiest to build and design in the end.

The gain of the finished receiver, in terms of absolute measurement, has very little meaning and is difficult to measure accurately, but it is safe to say that it is in the .05 to .1 microvolt region. The sensitivity of the i.f. strip alone is approximately 1 microvolt or better. By a direct comparison with the old superregen receiver, the sensitivity of the superhet receiver is 10 to 20 times as great. Signals that are just barely audible, yet not readable, on the superregen are S9 on the superhet. From S9 down to S3 or S4 a signal is workable on the superhet, and that means 15 to 20 db. of more workable signals than are available on the superregen. With the gain control set at the normal operating level there is no appreciable noise in the loudspeaker. At this level, all but the weakest signals come in with plenty of volume to be heard all over the house. Local signals require that the gain control be turned almost off to prevent their blasting the speaker. The selectivity is adequate, but not excessive. All but the very worst modulated oscillators are easily readable by detuning to the high side of their carriers. The actual bandwidth is somewhere around 100 kc. at 30 db. down. Three or four local stations can be on at the same time and provided they are not on the same frequency, they can be separated easily and four or five remote stations can be read between each of the locals. Local receivers cause very little trouble, if any. Some of the very bad ones are noticeable, but they are more of a nuisance than a menace inasmuch as they merely raise the apparent noise level of the receiver in the vicinity of the signal to which they are tuned.

The stability of the superhet is excellent and no oscillator drift is noticed after a fifteen to twenty minute warm up period. After that the calibration remains unchanged in spite of sudden line changes or other conditions. In listening to crystal controlled signals the receiver can be tuned to their frequency and left there all night. The quality of speech is noticeably better than that of the superregen. The first time one operates such a receiver, after listening to nothing but superregens, he is immediately impressed by two things; the total absence of noise and the improved quality of voices. Having once handled and listened to the receiver, it is almost impossible to return to the superregen in any of its forms, with satisfaction.

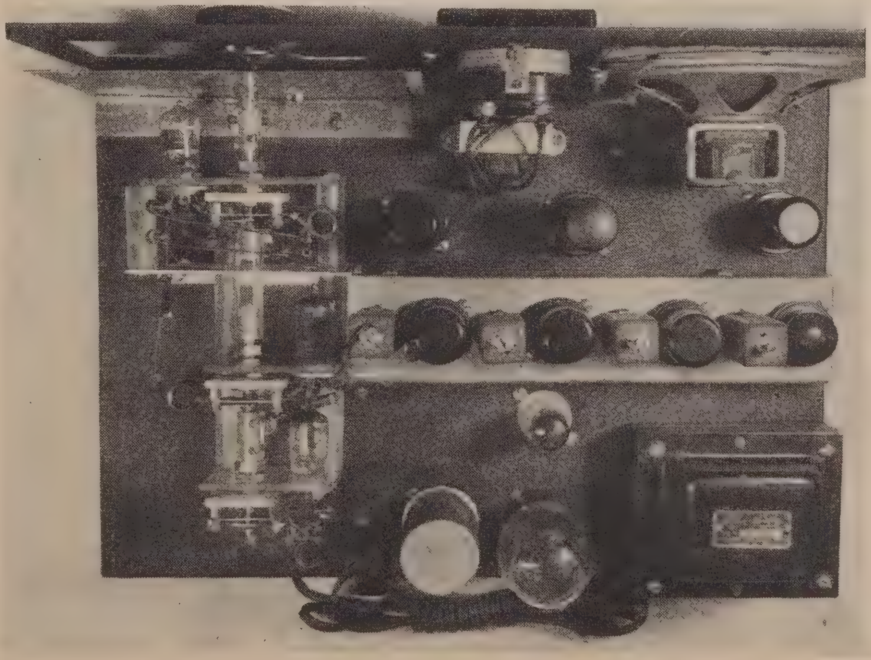
Some of the special features of this particular design include the use of separate assemblies in the more critical sections such as the i.f. channel, the local oscillator, mixer, and r.f. amplifier. The former, as can be seen from the illustration, is built entirely on a small chassis 1″ deep and 9″ long and includes the three 6AC7 tubes, the four i.f. transformers, the 6H6 second detector and all of the associated resistors and bypass condensers that go to make up this part of the circuit. This method of construction gives very complete shielding, something which is vital to the successful operation of three high gain stages at this frequency. In addition, it affords a high degree of flexibility. Since the amount of selectivity required is about the only consideration which might change in future years and obsolete the receiver, the fact that the entire i.f. and second detector section can be removed as a unit and redesigned, is pretty good insurance against the receiver becoming outdated. As the diagram shows, the three 6AC7s are run at their full normal ratings and no loading is resorted to across any of the transformer windings. This results in a very high order of gain being developed in these three stages and means that very great precautions must be taken against stray coupling which would cause oscillation or even regeneration. The layout shown facilitates this problem considerably.


Enlarged view of the r.f. section of the receiver shows relative placement of parts.

The transformers used in the final layout were purchased from war surplus and are tuned to 6 megacycles.

(*Continued on page* 142)

Top view of completed 144-148 mc. superheterodyne receiver.



RCA
RADIOTRON
ELECTRON
TUBE
832-A
RCA
RADIOTRON
ELECTRON
TUBE
829-B

The 829-B and 832-A at Audio Frequencies

Facts and figures on the operation of two popular twin-beam power tetrodes. These versatile tubes are ideal for both amateur rigs and p.a. systems.

By
JAMES A. FRED

TWO of the more versatile tubes on the war surplus market are the 829-B and 832-A. These are twin beam power tetrodes contained in one glass envelope. They are very compact and small in size.

All transmitting tube manuals carry voltage and current ratings for these tubes when used at radio frequencies. They are also quite efficient at the higher frequencies which make them attractive to amateurs. However there does not seem to be any available data on these tubes taken at audio frequencies.

Desiring to know if these tubes could be used at audio frequencies, the setup pictured in Fig. 1 was utilized to determine what could be expected in the way of audio output at moderate d.c. operating voltages. This is not a circuit which could be used in practical construction but one which was suited for this particular project. All measuring instruments are of the type generally found in well equipped industrial radio laboratories.

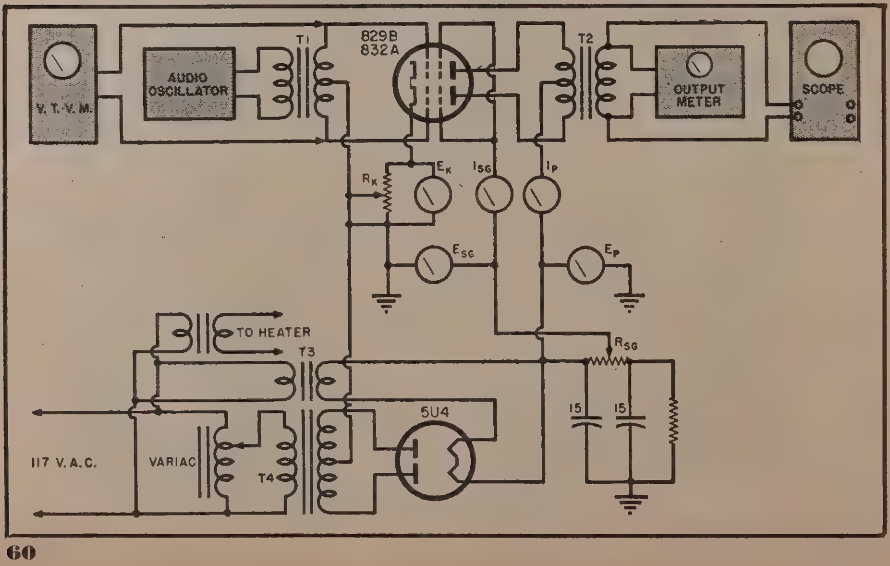
In the circuit diagram of Fig. 1 the 829-B or 832-A under test is furnished with continuously variable d.c. voltages by adjusting the variac in the primary of the high voltage transformer T_4. A simple filter circuit consists of the variable resistor R_{sg} and two 15 μfd. condensers. This reduces power supply hum to .05 mw. which was low enough for these tests.

A 400 cycle signal is fed to the push-pull input transformer T_1 by an audio signal generator. The audio voltage applied to the grids is measured by a vacuum tube voltmeter. The cathode voltage is varied by resistor R_k and is measured by voltmeter E_k. The screen grid voltage is varied by resistor R_{sg} and measured by voltmeter E_{sg} and screen grid current is measured by ammeter I_{sg}. The plate voltage is measured by voltmeter E_p and plate current is measured by ammeter I_p. The output goes to transformer T_2, a push-pull output transformer offering a plate load of 5000 ohms per plate, and is measured by an output meter. An oscillograph was used to check distortion of the output wave shape. Voltmeters and ammeters of ½ of 1% accuracy were used for other measurements. Filament voltage was maintained at 6.3 volts throughout the test.

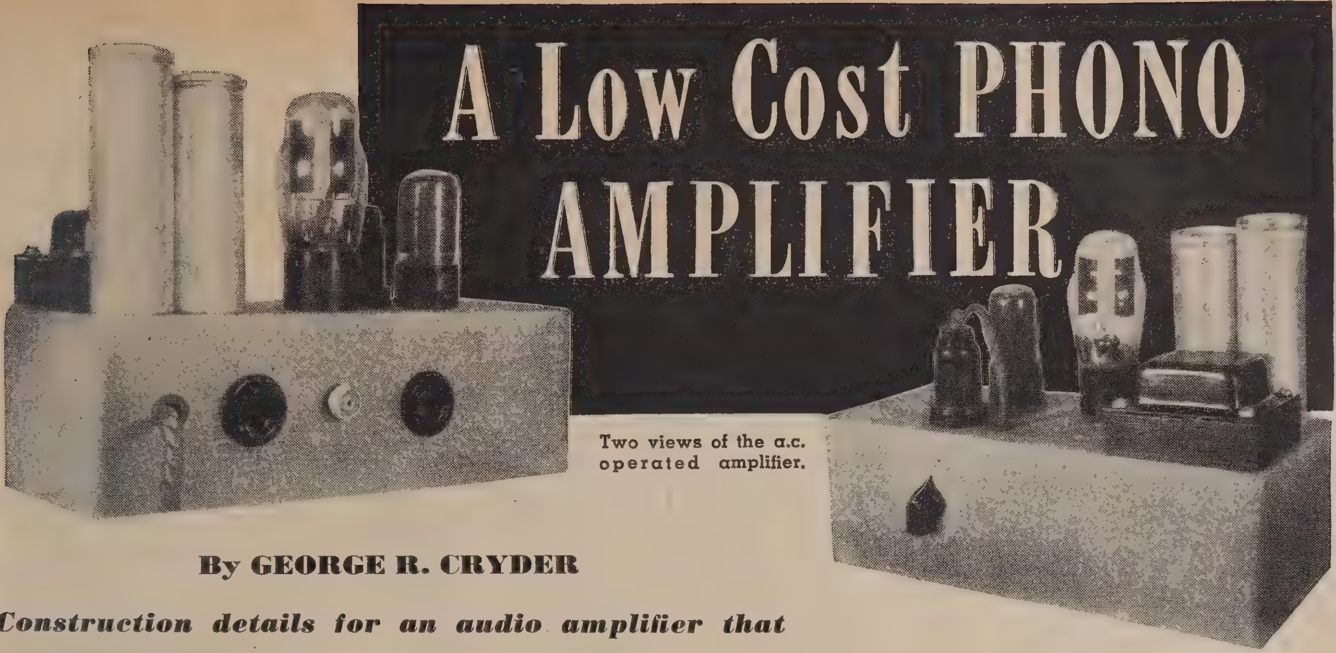
Table 1 shows the results obtained and voltages applied to the tube elements. Column 1 shows values arrived at with an 829-B tube with 500 volts on the plates. This is much less than the maximum voltage recommended by the manufacturer for r.f. operation. In column 2 are the values obtained from a power supply constructed with an ordinary receiver type power trans-

(*Continued on page* 172)

Fig. 1. Test set-up that was used to check operating characteristics of the tubes.



A Low Cost PHONO AMPLIFIER



Two views of the a.c. operated amplifier.

By GEORGE R. CRYDER

Construction details for an audio amplifier that is easy to build and requires a minimum of parts.

AFTER trying any number of different circuits for low power phono amplifiers, the writer has found the unit described in this article to be one of the most satisfactory. This is true both from the construction viewpoint as well as cost, as the amplifier uses only three tubes.

The tube line-up is quite conventional, utilizing a 6J7 as pre-amplifier which, in turn, drives a 6V6 beam-power amplifier tube in the output stage. This gives better than 5 watts, with a very low percentage of distortion. Five watts have also been found to give more than enough power to drive a 12 inch speaker at room or listening level. The rectifier is a type 80. Others could, of course, be used, such as the 5Y3, 83V, etc.

The photographs are self-explanatory but a few words on the design and construction might be in order. The first requisite was as low a hum level as possible, in fact, no audible hum when there was no input voltage. By using a little extra filtering in the power supply section this result was obtained quite easily. This extra filter is made up of the speaker field coil acting as an extra choke, with an extra 16μfd. electrolytic condenser.

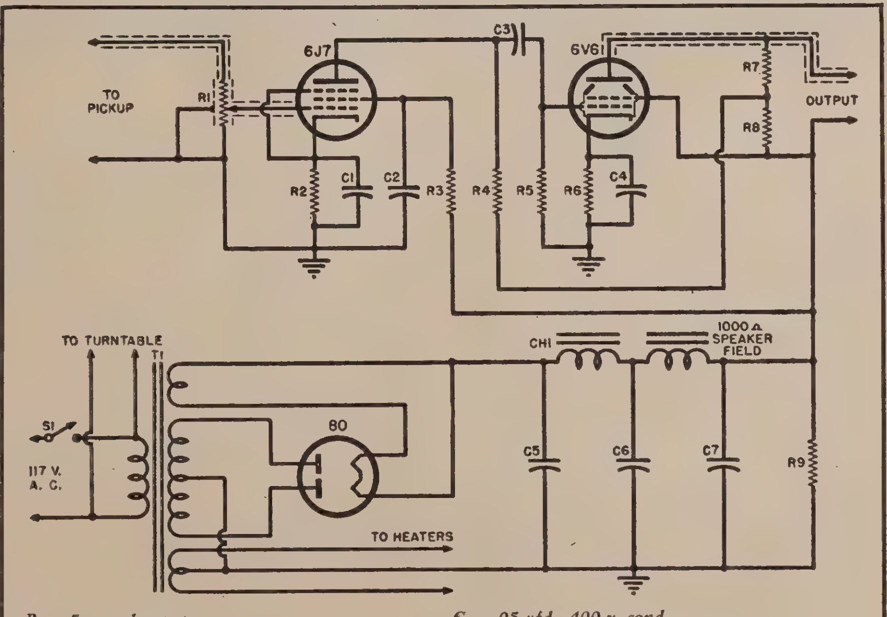
The method of obtaining inverse feedback in this circuit is only one of several possible ways. However, this parallel feed idea was used because it is simple and practically foolproof in actual operation. In this circuit some of the output voltage is picked off through a voltage divider network and is fed back, out of phase, into the grid circuit through the plate circuit of the 6J7. Of course this means a slight reduction in gain, which is governed by the ratio of the resistors in the network. This slight disadvantage is overshadowed, however, by the subsequent reduction in distortion, and a more linear response over the full frequency range of the amplifier.

The construction layout is quite conventional, all parts being mounted on a standard sized chassis. The filter choke, not visible in the photograph, is mounted below, but may be mounted wherever it is most convenient. The input circuit is, of course, shielded, and a little better results were obtained by shielding the output, especially when utilizing full output.

The 6J7 has plenty of gain so any of the better makes or types of crystal phono pickups may be used. In fact a carbon type mike may also be used with this amplifier by the addition of a mike input-to-grid transformer in the grid circuit of the 6J7. The use of a crystal or dynamic mike is not recommended, however, without the addition of another stage of amplification.

A power output plug has also been included for convenience. This makes it possible to plug the phono motor into the rear of the amplifier for 110 v., using only one power cord. —30—

Schematic diagram of the 3-tube audio amplifier. Power output is approximately 5 watts.



R_1—.5 megohm pot.
R_2—2000 ohm, ½ w. res.
R_3—1.5 megohm, ½ w. res.
R_4—250,000 ohm, ½ w. res.
R_5—.5 megohm, ½ w. res.
R_6—250 ohm, 1 w. res.
R_7—100,000 ohm, ½ w. res.
R_8—20,000 ohm, ½ w. res.
R_9—7500 ohm, 20 w. wirewound res.
C_1, C_4—25 μfd., 25 v. cond.
C_2—.5 μfd., 400 v. cond.
C_3—.05 μfd., 400 v. cond.
C_5, C_6—8 μfd., 400 v. elec. cond.
C_7—16 μfd., 400 v. elec. cond.
T_1—Power trans. 385-0-385 v. @ 100 ma.; 5 v. @ 2 amps.; 6.3 v., c.t. @ 1 amp.
S_1—S.p.s.t. sw. (on R_1)
CH_1—Filter choke, 200 ohm, 100 ma.
Speaker—Any size. 1000 ohm field coil with output trans. to match single 6V6
1—6J7 tube
1—80 tube
1—6V6 tube

The Recording and Reproduction of SOUND

Part 7. A discussion of representative microphones widely used in recording.

By
OLIVER READ
Editor, RADIO NEWS

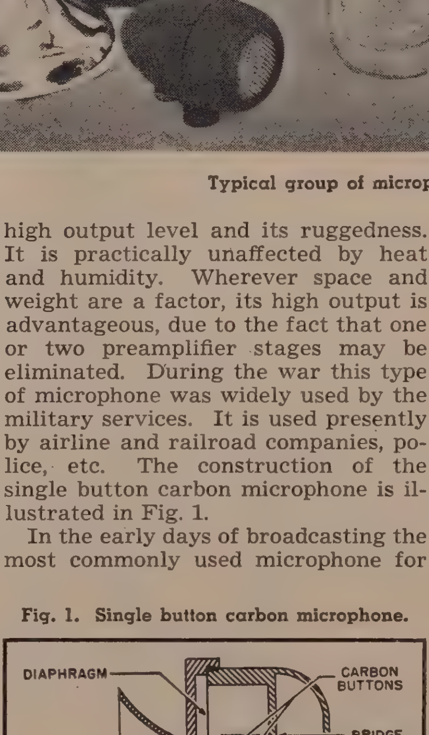
Typical group of microphones suitable for recording work.

THERE are three fundamental types of microphones (transducers). These are the carbon, crystal, and dynamic. Each type employs a specific fundamental principle of operation. While there are many variations on the above three types, we shall confine most of our discussion to the construction and application of those enjoying the greatest popularity.

A *carbon* microphone functions as follows: Direct current flows through the carbon granules. As the pressures and rarefactions of the sound waves occur at the diaphragm, the diaphragm is caused to move and to press and release the carbon granules. The action is decreasing and increasing resistance within the microphone. Accordingly, pulsating direct current results, the pulsating or alternating part having the same waveform as the original sound wave. The characteristic of the carbon microphone is its high output level and its ruggedness. It is practically unaffected by heat and humidity. Wherever space and weight are a factor, its high output is advantageous, due to the fact that one or two preamplifier stages may be eliminated. During the war this type of microphone was widely used by the military services. It is used presently by airline and railroad companies, police, etc. The construction of the single button carbon microphone is illustrated in Fig. 1.

In the early days of broadcasting the most commonly used microphone for high quality pickup was the *double button carbon.* This is illustrated in Fig. 2A. For many years this was standard equipment with all the broadcasters and, although it had its limitations, it proved very successful until replaced by the more popular velocity, dynamic, and other types. Carbon microphones, being of the pressure type, are largely used in mobile communications. They possess extremely good response at voice frequencies. The harmonic content of a single button microphone, due largely to the non-linearity of the carbon itself, is a source of at least 10% harmonic distortion even in the more advanced types. This, however, is no handicap when we limit the over-all response to voice frequencies. Generally speaking, carbon microphones are usually of 100 ohms impedance and are fed direct to a transformer or to a resistor input to the preamplifier.

Fig. 1. Single button carbon microphone.



Crystal Microphones

The *crystal* microphones, of which there are several types, employ bimorph Rochelle salt crystals. The

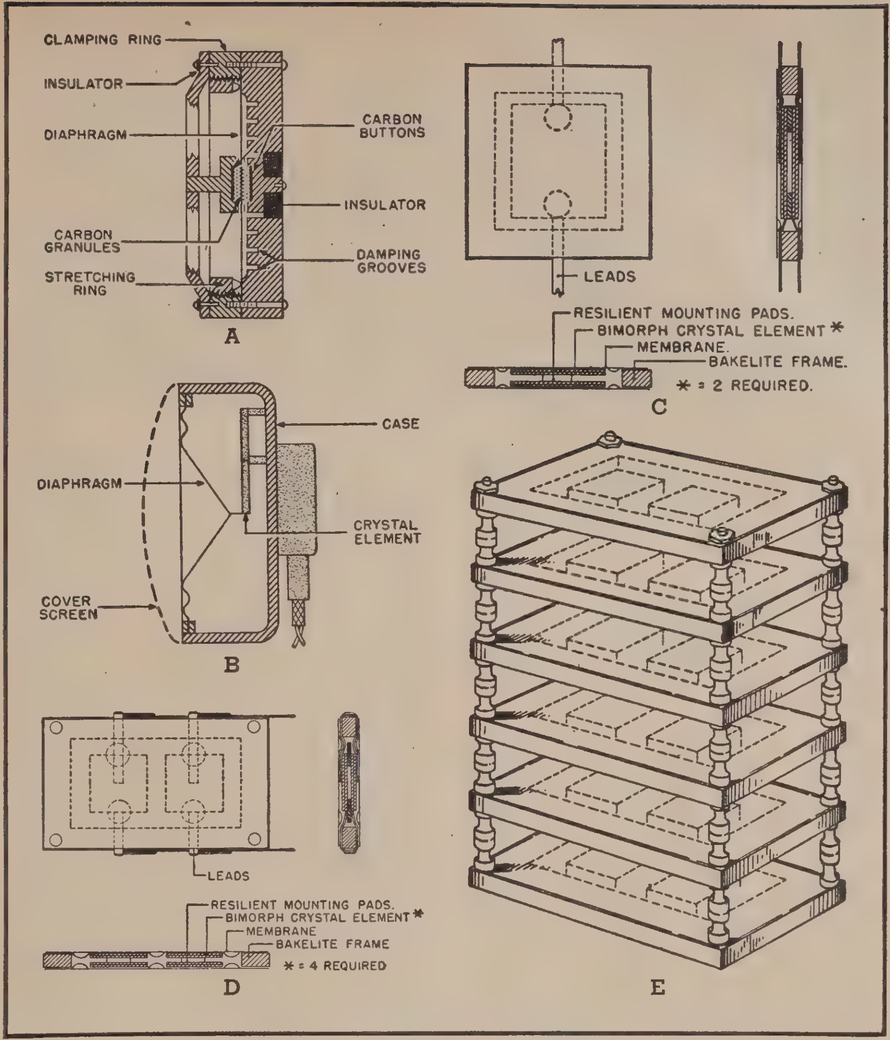


Fig. 2. (A) Double button carbon, (B) crystal diaphragm, (C) sound cell, (D) multiple sound cell and (E) six element sound cell construction.

crystal element itself consists of two Rochelle salt slabs which are assembled in such a manner that they respond to a bending stress. The two slabs are provided with three foil electrodes so that the assembly is capable of generating a potential between the inner and outer foils whenever subjected to a strain or bending. Fig. 2B illustrates the construction of a diaphragm actuated crystal microphone. A drive pin is connected to one or two corners of the crystal and the other end of the drive pin is attached to a diaphragm. The movement of the diaphragm and drive pin bends the crystal in accordance with the pressure of the sound waves. This creates an alternating potential of substantially the same wave pattern as the sound wave. A crystal microphone does not require a separate voltage or current source, as is the case with the carbon microphones. The output of the microphone, accordingly, can be connected directly to the grid of an amplifier tube. The chief disadvantage of the crystal is that its operation is confined to temperatures of less than 130 degrees F. Temperatures over 130 degrees F. cause the crystal elements to soften due to excessive heat and the microphone is rendered inoperative.

The construction of the crystal microphone illustrated in Fig. 2B is the simplest form of crystal microphone. They are widely used for communications mikes and for the tiny hearing aid devices.

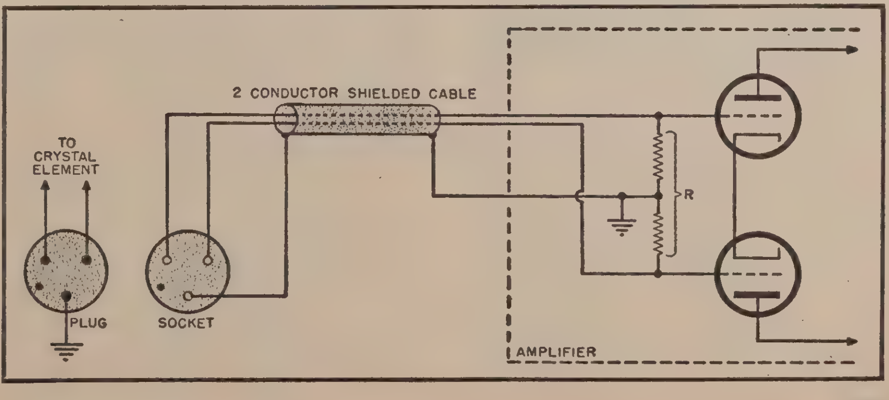
Sound Cell Microphones

A *sound cell* microphone consists of two bimorph crystal elements as illustrated in Fig. 2C. These elements are assembled back to back and are enclosed within a rectangular bakelite frame, sealed by two flexible membranes. The crystal elements are held together by two resilient mounting pads located in such a manner as to provide proper damping characteristics and to separate the elements, permitting them to deflect under application of sound pressures. No diaphragms are required in a sound cell microphone since sound pressures contact the crystal elements directly.

After assembly, the completed sound cell is impregnated with wax to render it airtight and moisture-proof. The result is a small, flat, hollow box, the two major sides of which generate a voltage in proportion to the applied pressure. For sound pressures, the voltage generated by one side will be in phase with that generated by the other and for this reason are additive. In the case of mechanical shock or vibration, the voltages will be out of phase and will tend to cancel each other. Due to the linear relationship between sound pressure and voltage, amplitude distortion does not arise as is the case with practically all other types of microphones. Crystal elements used in sound cells have been designed so that their mechanical resonances are usually above the highest frequency to be reproduced. In higher quality sound cell microphones, very small and very thin crystal elements are used, in which case the mechanical resonance is just above 10,000 c.p.s. causing the response to rise slightly at the upper frequency range. This increased output may be found useful in compensating for the high frequency loss in associated equipment, or it may easily be compensated for true equalization.

In some microphones single "sound cells" are used as illustrated in Fig. 2C. In others, double "sound cells" are used as illustrated in Fig. 2D. Usually a number of these are stacked together to provide proper operating characteristics. Sound cell microphones have been developed for various applications. They are ideally suited to high quality broadcasting, recording, audition and sound reinforcement applications. Generally, these are designed for connection to high impedance circuits but with special coupling transformers may be fed to low impedance lines. Each of these

Fig. 3. Input connections for sound cell microphones.



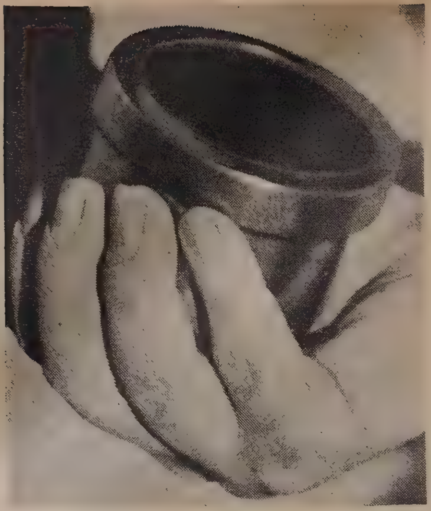


Fig. 4. Moving coil (dynamic) microphone.

microphones has a substantially uniform response up to 10,000 c.p.s. Each contains six double sound cells stacked as shown in Fig. 2E. The connections to the cells, however, differ for some models.

Sound cells have also been used in other devices such as laboratory microphones, artificial ears, etc. where very accurate measurements are required. For these applications the response is uniform up to 15,000 c.p.s. This is accomplished by using extremely small sized crystal elements (7/32 in. sq. x .015 in. thick) in which the mechanical resonance is well above 40,000 c.p.s.

Each sound cell microphone is terminated in a three point plug-in socket. Two of the contacts are connected to the output terminals of the sound cell assembly. The third contact is connected to the case of the microphone. This permits connection to single tube or push-pull grid inputs as shown in Fig. 3. Since the crystal elements of the microphone are capacitive over practically their entire frequency range, it is very important that each microphone be operated into the load impedance as recommended by the manufacturer. The capacity of the crystal elements will vary somewhat with temperature. However, this will have no effect on performance if recommended load impedances are used. Sound cell microphones should never be subjected to temperatures exceeding 125 degrees F. since the piezoelectric properties of the crystal elements may be damaged permanently.[1]

Non-directional Microphones

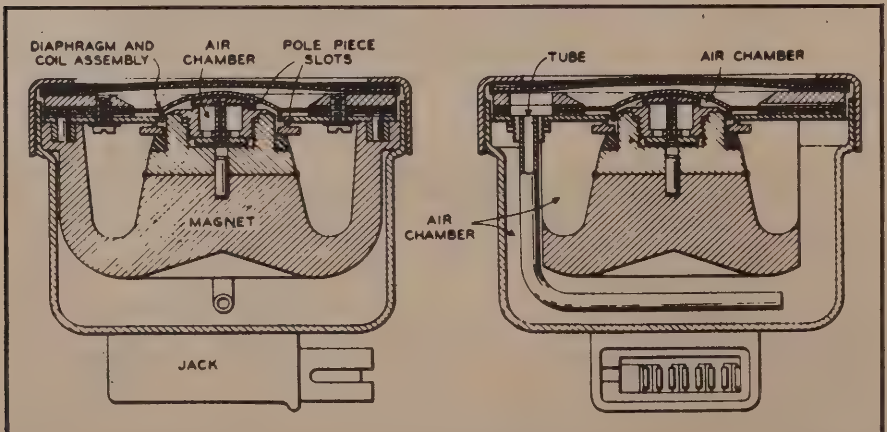
Pressure microphones respond to variations in sound pressure. They include dynamic, carbon, crystal, condenser, and ribbon microphones with closed backs. These are substantially non-directional although they tend to become directional at the higher frequencies. For a microphone of 2½" diameter, directivity starts at about 2000 c.p.s. and increases with frequency. Often baffles are used to lower the frequency at which directivity begins. But, as these add some frequency distortion, the design of the microphone must be coordinated with them.

The frequency response is uniform with respect to distance from the sound source excepting, of course, the frequency distortion caused by reverberation within the room in which the microphone is used. In a hard, untreated room this effect can be serious when working more than a foot or so from the instrument. Pressure microphones usually have comparatively stiff diaphragms and are therefore not as susceptible to wind and breath.

Carbon microphones of the pressure type are largely used for mobile communications service as mentioned previously. Pressure microphones in the dynamic type are available in high impedance (25,000 ohms) for feeding direct into grid or 50, 250 or 500 ohms for matching a line.

Pressure microphones are excellent all-purpose instruments for conditions where room reverberation, acoustic feedback, and ambient noise are not too severe. The better quality type are desirable for broadcast announcing and remote, public address, amateur communications, and recording. They are recommended for outdoor as well as for indoor work.

Fig. 5. Cross-section view of moving coil microphone.



Differential Microphones

This type of microphone was used by nearly all branches of the U. S. Armed Forces in reproducing speech through high surrounding noise. The same basic principle of operation makes it highly desirable for all applications where ambient noise is 100 db. or more. The *Differential*[2] discriminates against the distance of origin and not sound pressure alone. For example, if background noise originating from a foot or more away is the same sound level at the microphone as speech which originates one quarter inch away, the reproduced speech is from 17 to 20 db. higher than the noise, despite the fact that these two sound pressures arrive at the microphone at the same intensity. The *Differential* is made in both carbon and dynamic types and provides high articulation and good quality reproduction. For public address applications, the *Differential* shows remarkable freedom from acoustic feedback. It is essential, however, that they be used closely, to within ¼ inch to ⅜ inch, or speech itself will be attenuated. Basically, the *Differential* is a close talking microphone and is highly effective in reproducing speech under high ambient noise. It is ideally suited for use by railroads in their communications work. As a carbon hand-held microphone, it is used by many airlines and air transportation companies. It is also used by broadcasters for sporting events, such as boat races, where the background noise is high.

Broadcast Microphones

The following paragraphs will deal with several representative types of high quality microphones designed especially for broadcast applications or for use in professional sound recording studios.

Most stations prefer velocity or "ribbon" microphones for studio work, because of their wide-angle pickup and adaptability to various applications, while dynamic or moving-coil microphones are used in outdoor or remote broadcasts where ruggedness plays a major part. Cardioids, of course, are suitable for all applications and receive a good deal of use.

A good example of the moving-coil type of microphone is the *Western Electric* 618-A (Figs. 4 and 5). This microphone has long been used where ruggedness, good frequency response, and ease of handling are requisites, and is especially suited for use in the broadcasting (or public address) of outdoor events. It holds an advantage over the ribbon type in such events in that it is not so easily damaged by reasonably rough handling, is not as sensitive to "blasts" or instantaneous peaks of excessive level, is not adversely affected by wind, and, by virtue of its unidirectional characteristics, aids considerably in the reduction of background noise usually present in outdoor applications.

The high-frequency response above

(*Continued on page* 118)

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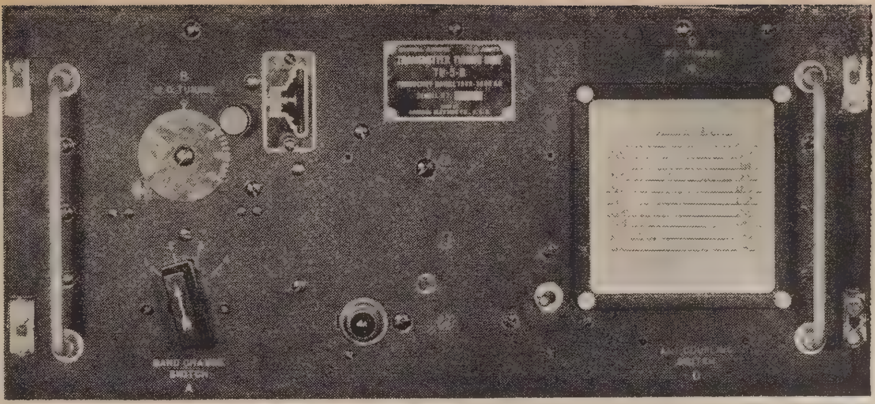
[1] Brush Development Co., Brush Technical Bulletin No. 320.

[2] Electro-Voice Microphones.



Front panel view of the completed v.f.o. This unit was built from a Signal Corps transmitter tuning assembly, TU-5-B, designed to cover the range of 1500-3000 kc. →

A Variable FREQUENCY OSCILLATOR

By
ROBERT W. FIELD,
W4KAP

Conversion of a popular war surplus tuning unit into a stable v.f.o. that covers the frequency range from 3.5 to 4 megacycles.

THE present day crowded conditions existing on the amateur bands make a variable frequency oscillator a very desirable addition to any station. This is especially true of low power rigs.

It was decided to build a v.f.o. to cover the range from 3.5 to 4.0 megacycles. The unit was required to have sufficient stability to allow for doubling even to the 28 megacycle band. Examination of one of the plug-in tuning units, originally built to be used with the BC-191F and BC-375E Signal Corps transmitter, convinced us that here was the ideal foundation unit for use in constructing a variable frequency oscillator. The tuning units are readily available at a cost of less than five dollars. They come complete with a crackle finish, steel dust cover which is used for the final v.f.o. cabinet. Six different frequency tuning units are available, however, the 1500 to 3000 kc. range was selected as it was felt that this choice would result in a higher "C" circuit at the desired 3.5 to 4.0 mc. range.

These units are beautifully constructed, having temperature-compensated condensers in shunt with each fixed condenser that is used in the oscillator tank circuit. This results in a high degree of stability.

Actually the unit is free from noticeable drift after the heaters have been turned on for only a minute or two.

The original tuning inductance is constructed of heavy wire wound on a threaded isolantite form. Only eleven turns were found to be needed but rather than remove turns and take a chance of loosening the winding it was decided to merely tap down on the coil.

The dial supplied with these units is ideal for v.f.o. use, having a total of 2500 divisions for a range of 3500 to 4000 kc. This means that five divisions are equal to only one kilocycle change at the fundamental frequency. The original tuning unit is built with the vernier dial and main tuning condenser located on the left hand side of panel. Directly below the dial is a fan-type range switch that was used for increasing the capacity in shunt with the main tuning condenser. Each of these steps, as previously mentioned, has a bimetallic strip arranged for compensating temperature drift.

It was found that the desired range could be obtained with a total of 200 μμfd. in shunt with the main tuning condenser. This value of capacity is obtainable with the switch in position No. 2.

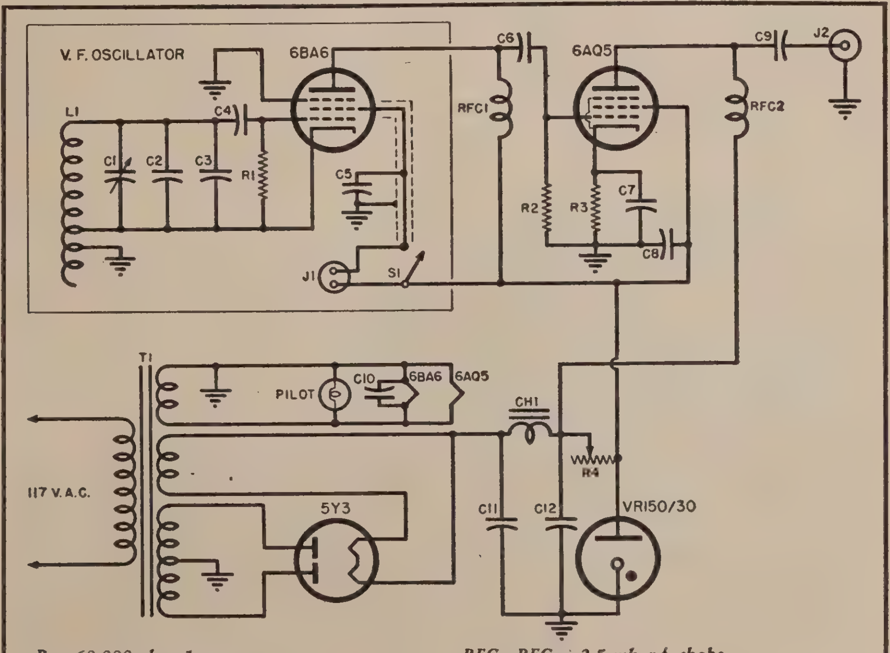
To prevent the Junior Ops from accidentally throwing this switch and getting their OM in dutch with the FCC it was felt that this switch should be locked.

This was readily accomplished by soldering a metal strip to the switch mechanism.

The photograph shows an aluminum

(*Continued on page* 163)

Schematic diagram of the variable frequency oscillator.



R_1—68,000 ohm, 1 w. res.
R_2—100,000 ohm, 1 w. res.
R_3—200 ohm, 1 w. res.
R_4—5000 ohm, 25 w. wirewound var. res.
C_1—Tuning cond. (See text)
C_2, C_3—100 μμfd. cond. (temperature compensated)
C_4, C_6, C_9, C_{10}—100 μμfd. mica cond.
C_5, C_7, C_8—.01 μfd. mica cond.
C_{11}, C_{12}—8 μfd., 450 v. elec. cond.
L_1—Original coil, 11 t. total used, tapped at 4 t.
RFC_1, RFC_2—2.5 mh. r.f. choke
S_1—S.p.s.t. sw.
J_1—2-contact connector
J_2—Single-contact connector
CH_1—30 hy., 70 ma. choke
T_1—Power trans. 350-0-350 @ 70 ma.; 5 v. @ 2 amps.; 6.3 v. @ 2 amps.
1—5Y3 tube
1—VR150/30 tube
1—6BA6 tube
1—6AQ5 tube

SOUND BROADCASTING from Airplanes

Temporary installation of 100 watt loudspeaker and amplifier in a Piper Cub. Speaker projects out of open door.

The installation and servicing of sound equipment in planes can provide an added source of income for the radio serviceman.

By SAUL J. WHITE

Chief Eng., University Loudspeakers, Inc.

DURING the war high-powered sound systems were used in military aircraft for sound broadcasting to the ground during invasion operations, and for propaganda purposes. The Coast Guard has equipped planes with sound systems for its Air-Sea Rescue Division. Now, with the peace, there is a growing interest in "sky broadcasting" for commercial advertising. Former military pilots and radiomen have turned to this novel field of advertising as a lucrative and exciting occupation. One enterprising flying corporation, organized by ex-G.I.'s, has equipped five airplanes for air-to-ground advertising. A Morristown, New Jersey, flying service has equipped an autogyro similarly.

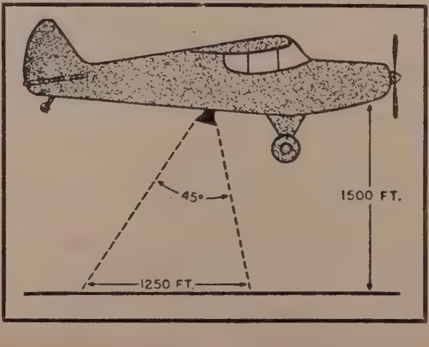
Power Requirements

For effective airplane broadcasting of sound, audio power of 100 watts or more is required. Energy below this is unreliable because of the effect of wind, noises on the ground, and the necessity for flying at considerable heights, especially over congested areas. It is preferable that this full power be handled by a single loudspeaker. If greater sound coverage is desired, additional speakers each capable of handling 100 watts should be installed, and corresponding increases of amplifier output made available. Speakers with narrow projection angles are most effective because of the concentration of sound intensity on the ground. To obtain maximum intelligibility and acoustic output, both the loudspeaker and the amplifier should be so designed as to cut off all frequencies below 200 or 300 cycles. Low frequency or bass notes do not add to the clarity, but only serve to overload the equipment. Most plane engine noises are in the low frequency range, and hence this type of pickup through the microphone is minimized where the bass is cut off in the amplifier and speaker. Where high intensity and wide ground coverage are required, the practice is to use either a greater number of speakers or a single speaker with wide dispersion angle capable of handling greater audio power, 200-300 watts.

Dispersion Angle

The dispersion angle of the loudspeaker is of some importance in the case of high speed planes from which an announcement or message of any length is to be broadcast. It can be realized that if the beam of the speaker is narrow or sharp and the plane is traveling at 100 m.p.h. or more, that the projection area on the ground would pass over a stationary listener in a very short space of time, usually a matter of seconds. Therefore, it becomes necessary that all announcements be made short and that they do not exceed the estimated "ground time" which is determined by the dispersion angle, the rate of speed of the plane, and its height. Consider the case shown in the following illustration. Here a plane flies at 1500 feet, at a speed of 100 m.p.h. The speaker has a dispersion angle of 45°, this representing the width at which maximum intelligibility and intensity is obtained. It is, therefore, a matter of very simple computation to realize that a message from the plane covers a ground diameter of 1250 feet and could be heard by a listener for only nine seconds.

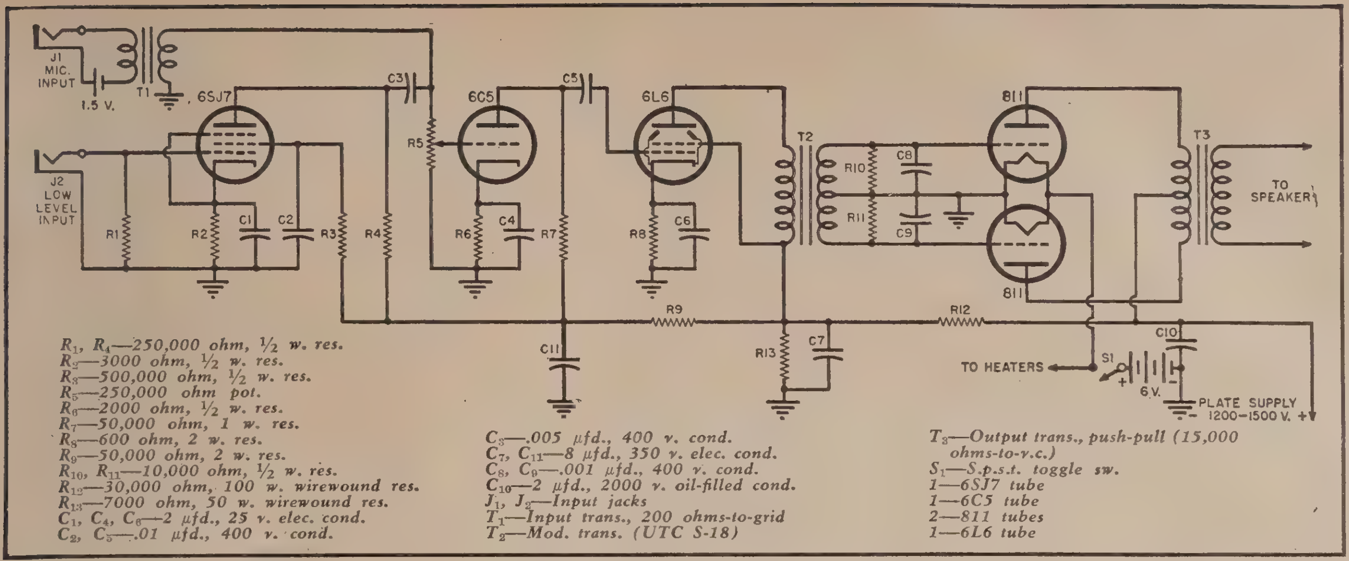
Determination of dispersion angle of loudspeaker is necessary in order to gear an advertising message for maximum intelligibility with relation to the listener.



Reduction of Acoustic Feedback

Because of the high power required and the fact that the loudspeaker is within a few feet of the microphone, acoustic feedback may occur before the necessary sound intensity is obtained. The following recommendations are made to permit larger volume to be built up before feedback occurs.

First, the loudspeaker should be so mounted that it points slightly to the rear of the plane. In other words, in addition to pointing downward, it must also point to the rear. This allows the sound to flow partially with the slip stream. The microphone should



R_1, R_4—250,000 ohm, ½ w. res.
R_2—3000 ohm, ½ w. res.
R_3—500,000 ohm, ½ w. res.
R_5—250,000 ohm pot.
R_6—2000 ohm, ½ w. res.
R_7—50,000 ohm, 1 w. res.
R_8—600 ohm, 2 w. res.
R_9—50,000 ohm, 2 w. res.
R_{10}, R_{11}—10,000 ohm, ½ w. res.
R_{12}—30,000 ohm, 100 w. wirewound res.
R_{13}—7000 ohm, 50 w. wirewound res.
C_1, C_4, C_6—2 μfd., 25 v. elec. cond.
C_2, C_5—.01 μfd., 400 v. cond.
C_3—.005 μfd., 400 v. cond.
C_7, C_{11}—8 μfd., 350 v. elec. cond.
C_8, C_9—.001 μfd., 400 v. cond.
C_{10}—2 μfd., 2000 v. oil-filled cond.
J_1, J_2—Input jacks
T_1—Input trans., 200 ohms-to-grid
T_2—Mod. trans. (UTC S-18)
T_3—Output trans., push-pull (15,000 ohms-to-v.c.)
S_1—S.p.s.t. toggle sw.
1—6SJ7 tube
1—6C5 tube
2—811 tubes
1—6L6 tube

Schematic diagram of a 150 watt audio amplifier. The mike input is for a single-button carbon lip mike, while the low level input may be used for the input of a wire recorder.

be located "upwind" from the loudspeaker.

A great improvement will result if the loudspeaker mouth projects about a foot into the slip stream or beyond the fuselage of the plane. The best possible results are obtained where the entire loudspeaker is hung outside of the fuselage and mounted on a wing strut or under the nose of the plane.

Microphone

If the reproduction is to be obtained from a microphone, it is imperative that only a close talking microphone be employed. The recent lip type microphones and especially the differential type are excellent for reducing feedback to a minimum as well as eliminating a lot of the engine noises which would otherwise be picked up by the microphone and reproduced over the speaker.

Phono

Reproduction from a phonograph would be extremely difficult from an airplane because of the vibration and the banking. Unless an extremely complicated design were worked out, it would be impossible for the pickup to ride in the record groove. Reproduction from a magnetic wire or tape recorder, or film sound track, however would be excellent since these are not affected by vibrations and other normal maneuvers of the airplane. Magnetic recorders, however, are unquestionably the best source for the message. Announcements are recorded in advance on the ground.

Wind

Wind is an element which frequently ruins what would otherwise have been a good performance, but unfortunately the results can not be made uniform because of the variation in wind velocity and direction of the airplane. The effect of variable wind in any direction would be to cause considerable fading and this effect will increase as the distance between the listener and the loudspeaker increases. If the wind is gusty and the plane engages in changes in heading, the sound as the listener hears it will vary in intensity.

Power Supply

Most sound installations in aircraft operate from a rotary converter, using 24 or 32 volts d.c. storage battery input and having 110 volt a.c. output, which is fed to the amplifier. This naturally entails considerable amount of weight and, of course, the plane must be capable of carrying this load in addition to the weight of the amplifier and loudspeaker. The rotary converter method is the simplest because it permits the use of available commercial amplifiers. However, where weight is at a premium, as in a light plane of the Piper Cub class, and it is imperative that equipment weight be reduced, the amplifier should be custom-built to operate from 12 volts d.c., utilizing a genemotor delivering the required d.c. *plate* voltage. This eliminates the weight of the high voltage and filament transformers. The circuit should eliminate all nonessential features, contain only the necessary input and output channels. Where a low frequency cut-off of 300 cycles is specified, the weight of the output transformer can be reduced. The circuit should be reduced to the simplest form.

In certain planes it may be possible to couple a 110 a.c. generator to some part of the power plant so that at cruising r.p.m. the generator driven by the engine will deliver the correct voltage. However, this is difficult in most engines below 200 h.p. because

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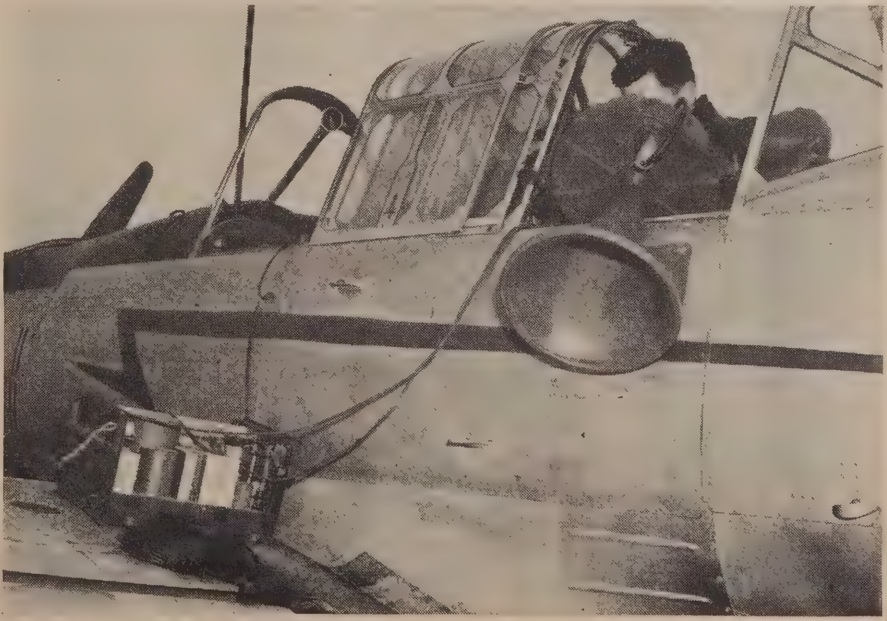
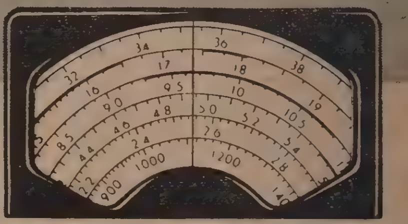
A Consolidated Vultee AT-6, purchased by an ex-AAF pilot from Army surplus, is shown being equipped with a University Model B-6, 150 watt loudspeaker unit.



International SHORT-WAVE



Compiled by KENNETH R. BOORD

WE ARE pleased this month to dedicate the ISW Department to radio in Ceylon, and particularly to *Radio SEAC* (South East Asia Command), Colombo.

Thanks go to Chief Engineer Bernard Blakemore for permission to draw from material he wrote in the May issue of SEAC Forces' Radio Times, which publication is edited by Ronald George. An operational outline, the technical aspects of the station, and "*Radio SEAC* and You, the Listener" are subjects covered in a technical supplement that has recently been issued by the station. This folder may be obtained from the Chief Engineer. The Forces' Radio Times is distributed throughout Aden, India, Burma, Ceylon, China, Malaya, Borneo, New Zealand, Australia, Japan, British Pacific and East Indies Fleets, and selected listening posts throughout the world.

Radio SEAC, The Forces Broadcasting Station, first came on the air as experimental station ZOJ in October 1944, radiating for only a few hours each day from a borrowed transmitter and from borrowed studio space. In March 1945, a 7½-kw. transmitter beamed eastward from Ceylon opened and the station's name became *Radio SEAC*. Broadcasting hours were increased to 9½ per day. During this time, however, a bigger station was being planned and the first experimental transmissions with the 100-kw. unit were made in April 1946. On the first day of May the new schedule started, including 16½ hours a day on two transmitters—the new 100-kw. unit and the original 7½-kw. *RCA* transmitter.

The broadcasting system of *Radio SEAC* now consists of three main units—the receiving station at Horahena, the studio center in Colombo, and the transmitting site at New Ekala. All are situated on the western side of Ceylon and the transmitting site is particularly suitable as the island is surrounded in all except the northerly direction by vast oceans.

The station, when planned, was intended specifically to provide a good signal over the area included in the South East Asia Command and, in addition, has facilities for beaming transmissions to Australia and New Zealand, and to the United Kingdom.

At the present time the antenna systems in daily operation are beamed on India (350° N. of W.) and Japan (036° E. of N.) and the Pacific (080° E. of N.) and once a week, on Sunday evening (in Ceylon), the United Kingdom beam is brought into operation on a bearing of 322° N. of W., which array can also be used on its reciprocal for Australia and New Zealand.

Entrance to Radio SEAC's transmitting site located among the coconut palms 15 miles outside Colombo. The site is guarded by Ceylonese soldiers. The Sinhalese driver of the passing bullock cart shows great interest in the camera. Difference between "Ceylonese" and "Sinhalese"? The "Sinhalese" are a race, oldest in Ceylon. "Ceylonese" is a generic term embracing all subjects of Ceylon, including Sinhalese, Tanils, and Burghers (descendents of early Dutch and Portuguese settlers).

The receiving station at Horahena is equipped with two banks of *RCA* AR-88 receivers which are used in triple diversity to receive transmissions from the United Kingdom and *Radio Australia*. In all cases, rhombic antennas are used and are fed to the receivers via wide-band r.f. amplifiers and the usual line switching and monitoring facilities are provided. The audio output from the receivers is fed to the studio control room and thence to the transmitting site by overhead telephone line.

The transmitter building houses one 100-kw. *Marconi* SWB-18 transmitter and two operational *RCA* ET-4750 7½-kw. units. In addition, one small 1-kw. transmitter is also in operation and it is hoped that another 7½-kw. transmitter of a similar type will be available in the near future. "Even so, these transmitters do not allow us to take full advantage of all the facilities available in the shape of antenna systems," comments Chief Engineer Blakemore, "but do, however, provide general coverage over South East Asia."

The 100-kw. transmitter is normally directed on Burma and Japan but has an antenna system which is designed to provide a wide beam of approximately 70 degrees. The two *RCA* transmitters are normally operational on the India beam on 49 meters and the Pacific beam on 16 meters. From this it will be appreciated that though the operational frequencies are not always optimum, under favorable conditions a good signal should be maintained for the greater part of the day throughout India, Burma, Malaya, the near Pacific and Japan.

The 100-kw. transmitter, although of utility construction, is of modern design and follows very closely the lines of its more expensive brothers; the output stage uses two *Marconi* CAT-17 tubes which are modulated by "Class B" modulation using two CAT-20-C tubes. The input to the final amplifier is normally 110 to 150 kw., depending upon the frequency in use. The r.f. driver unit consists of a ten-way thermostatically controlled crystal oscillator, the crystals for which

NOW!

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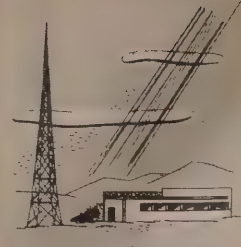
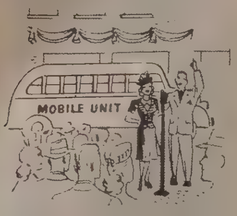

RADIO STATION STANDBY

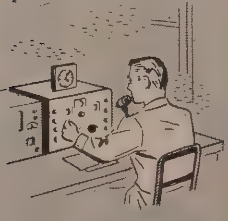


MOBILE RADIO UNITS

GEOPHYSICAL SURVEY

MUNICIPAL SIGNAL STANDBY

RAILROAD RADIO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"SPOT" RECORDING

A.C. OR D.C.

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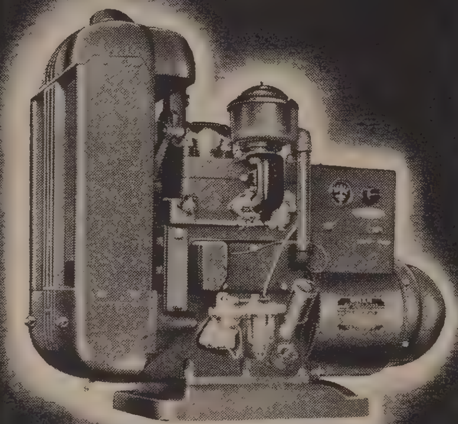

Onan Electric Plants are completely self-contained, dependable power units built in a wide range of sizes and standard voltages.

Lightweight, one or two-cylinder, air-cooled models offer the maximum in portability for many applications. Portable A.C. models—350 to 3,000 watts; portable D.C. models—600 to 5,000 watts.

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WRITE FOR FOLDER

●

ONAN Electric Plants are available in many sizes and models. ALTERNATING CURRENT: 350 to 35,000 watts in all standard voltages and frequencies. DIRECT CURRENT: 600 to 10,000 watts, 115 and 230 volts. BATTERY CHARGERS: 500 to 3,500 watts; 6, 12, 24 and 32 volts.

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PRODUCTS

are ground to comparatively low frequencies. The feeder lines are low impedance four-wire feeders but the design of the antenna varies according to requirements. "The highly directional antennas are four-bay, four-stack with reflectors, and the broad beamed arrays consist of three stacked Krauss dipoles," Mr. Blakemore explains.

The *RCA* transmitters are of similar design using high level modulation, and are associated with similar antennas systems.

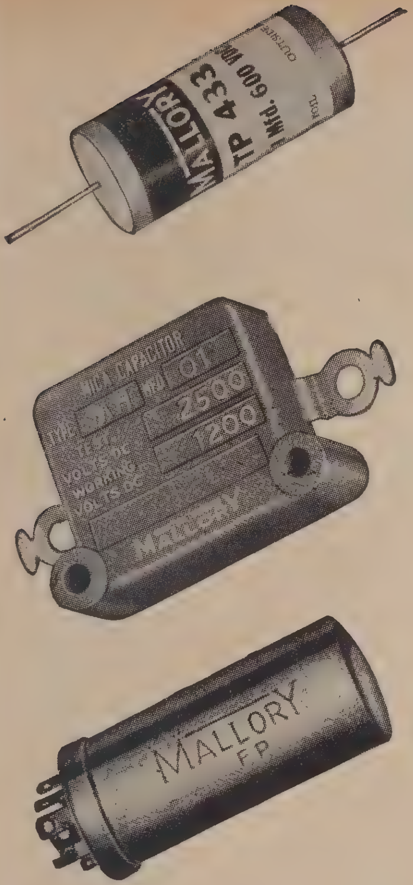
The Studio Center is equipped to provide live transmission or recorded programs and any compromise between the two. *Radio SEAC's* suite of studios is located at 191, Turret Road, opposite the Town Hall in Colombo.

"Interested *SEAC* listeners who find themselves at any time passing through or stationed in Colombo are most welcome to come in and be conducted over the premises," Mr. Blakemore invites.

"The technical problems involved in providing worthwhile broadcast entertainment over such a wide area as South East Asia are quite complex," Mr. Blakemore comments. "Although advantage can be taken of the very favorable propagation conditions in areas of similar latitude, the rapidly changing ionospheric conditions when beaming transmissions to northern latitudes must constantly be watched. The target area for the main transmissions is included roughly in an arc from Karachi in the northwest to Japan in the northeast and Singapore, Sumatra, and Java. To cover this area adequately, quite a number of high-power transmitters would normally be required, using various frequencies, as the propagation conditions change quite quickly throughout the day, and the static levels are high owing to climatic conditions. A compromise between the use of high-gain arrays and the provision of broad coverage must therefore be arranged.

"The ideal arrangement would be to have a number of high-power transmitters with high-gain antenna systems so arranged to cover the whole area," according to Mr. Blakemore. "The advantage of this arrangement becomes obvious when it is realized that with a high-gain antenna system the signal strength in the United Kingdom may be many times stronger than the present signal in Singapore, although the distance is almost five times as great. Were our transmissions concentrated on specific areas by using the multi-beam system, there is little doubt that a good signal could, at all times, be maintained, throughout the service area."

The frequencies at present allotted for the use of *Radio SEAC* are 3.390 to 3.395 in the 88-m. band; 6.075 in the 49-m. band; 9.520 in the 31-m. band; 11.770 in the 25-m. band; 15.120 in the 19-m. band; 17.770 in the 16-m. band; and 21.62 in the 13-m. band—five of which are now constantly in use at various times of the day; others being



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Service jobs that don't kick back are the ones that make a profit for you. When you use Mallory capacitors in your service work, you use capacitors *that don't kick back.* That's true whether the job calls for paper, mica or electrolytic capacitors.

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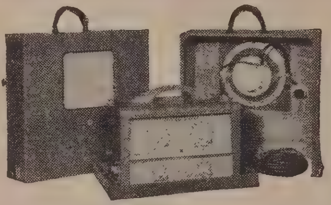
"It makes a big difference to have a complete line that meets every sales situation in the community," say Stromberg-Carlson Sound Equipment dealers.

The complete line *is* one great advantage, but here are more! The Stromberg-Carlson name stands for extraordinary designing, engineering and manufacturing skills. It has a sound reputation for customer acceptance. Stromberg-Carlson products have proved their profit-making qualities with scores of satisfied dealers.

Today, the widening sound equipment market welcomes the newest of Stromberg-Carlson scientific advances and the latest modern developments that make the line more complete than ever before. Why not inquire about a dealership? A limited number are still available.

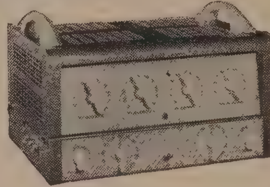
Here are a few typical products

PORTABLE SOUND SYSTEM, MODEL PS32



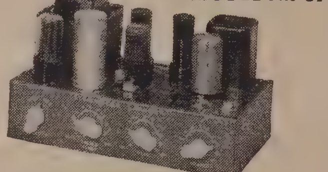
Portable system in a three-section, compact case. 15 watt amplifier with one phonograph and two microphone inputs, two heavy duty Alnico V reproducers, and 25 feet of durable cord with connectors attached. One case acts as the reproducer receptacle for connecting in cascade. Underwriters approved.

AMPLIFIER, MODEL AU 35



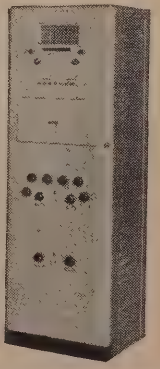
One phonograph and three microphone high impedance inputs, separate bass and treble controls, 50 watt divided output with separate master volume control. Additional amplifier jack for tandem operation. Hum adjuster, resistor board construction and rugged copper plated steel chassis. Underwriters approved.

AMPLIFIER, MODEL AR 37

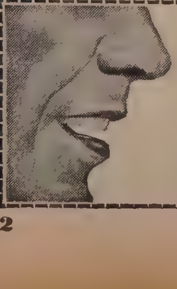


Two input jacks, one provides equalization network for crystal pick up, the other may be bridged across 500-600 ohm circuits, without change in level. Treble attenuation and boosts, bass boost, bass compensator volume control give the finest in record and wired-music reproduction.

SOUND SYSTEM, MODEL SS 750



A completely pre-engineered system. Incorporates AM-FM radio tuner, record changer, controls, and 90 watts of audio-power divided into four output circuits. Wired for optional remote control turret. Rugged all-metal cabinet with glacier-grey finish. Underwriters approved.



STROMBERG-CARLSON

STRAIGHT-LINE COMMUNICATION

brought into service as varying conditions demand.

Schedules

Normal schedules of *Radio SEAC* are:

Main Program—1930*-1200, 6.075, 9.520, 3.395; 1930-2300, 2330-0500, 0700-1200, 15.120; 2300-0730, 1100-1200, 17.770. On Saturdays, 0830-1200, BBC sports and music are carried on 17.770, 3.395. On Sundays, the Main Program terminates at 1115, and the special transmission intended as a link between the Forces out East and their people at home, is directed to the United Kingdom, 1130-1330, on 15.120; various other frequencies parallel, irregularly; recently, 17.770 has been reported in dual to Britain, while 9.520 and 6.075 have been directed to India and East Asia; about 7.185, formerly used in the United Kingdom (Sunday) beam, may be used again on occasion. *(Since Britain has turned back the clock by one hour, it is possible that Radio SEAC's Sunday beam to the British Isles may be heard one hour later, that is, 1230-1430.)* Daily news bulletins are scheduled for 2000, 2200, 0030, 0300 (BBC), 0600, 0730, 1000 (Radio Newsreel from BBC), and 1100 (BBC).

Indian Forces' Program—2300-2330, 0500-0700, 15.120.

Listed recently as special broadcasts are—daily, except Sunday—relay of BBC news items from London papers at 0700-0710, and Forces Educational Broadcast, 0710-0730, 17.770, 6.075.

Station officials point out that "these schedules are subject to change, of which the only warning will be preliminary microphone announcements."

The station, originally a SACSEA Unit, is now operating under the control of the Director of Army Welfare Services, the War Office (A.W.S.S.), London. The station director, Wing Commander A. E. Smith, is responsible to the Director of A.W.S.S. for the detailed running of the station, and the station's adherence to the policy laid down. A committee representing all three Services—Army, Navy, and Air Force—meets periodically in Singapore to review the activities of *Radio SEAC* and to coordinate points raised by the various areas served.

Broadcast policy of *Radio SEAC* is: *"Entertainment plus news, and a link with home."*

Average mail from listeners is 8000 letters a month, most of them being, naturally, for requests. Officials say "the closest attention is paid to complaints (which are happily few) and all suggestions received. Reception reports arrive from all parts of the world—Sweden, oddly enough, sends most from Europe—and all are acknowledged. We modestly cannot think why, but there are regular listeners to *Radio SEAC*, incidentally, in every city in the United States." *(The sta-*

(Continued on page 112)

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* Unless otherwise indicated, time herein is expressed in American EST on a 24-hour clock basis; *add* 5 hours for GCT. "News" herein refers to newscasts in the *English* language.

Raise An Effective Antenna in TEN MINUTES!

De Luxe
GROUND PLANE ANTENNA

Ground plane antennas are particularly good for increasing signal strength to other vertically polarized antennas such as used on mobile equipment. Also because of the low angle of radiation, it is quite effective for distance work.

The antenna consists of five sectional elements of copper plated steel tubing. The vertical element is electrically a quarter wave in length or about 8′ for the 10 meter band. It is mounted on a large ceramic insulator which feeds through the metal horizontal element support. The lower end of the vertical element terminates with a coaxial cable connector so it is only necessary to connect a suitable length of RG8U, or other low impedance coax cable, to your transmitter.

- Easiest of all antennas to put up
- Low angle of radiation
- No tuning problems
- Built to withstand weather
- Requires a minimum of space
- Low priced

The antenna is shipped complete with a strong steel chain clamp assembly that may be mounted on a chimney, tree, mast or any vertical or horizontal support.

The Ground Plane Antenna is made to withstand extreme weather conditions. One of the nation's leading antenna manufacturers built them to rigid Army standards at a cost of several times our low price.

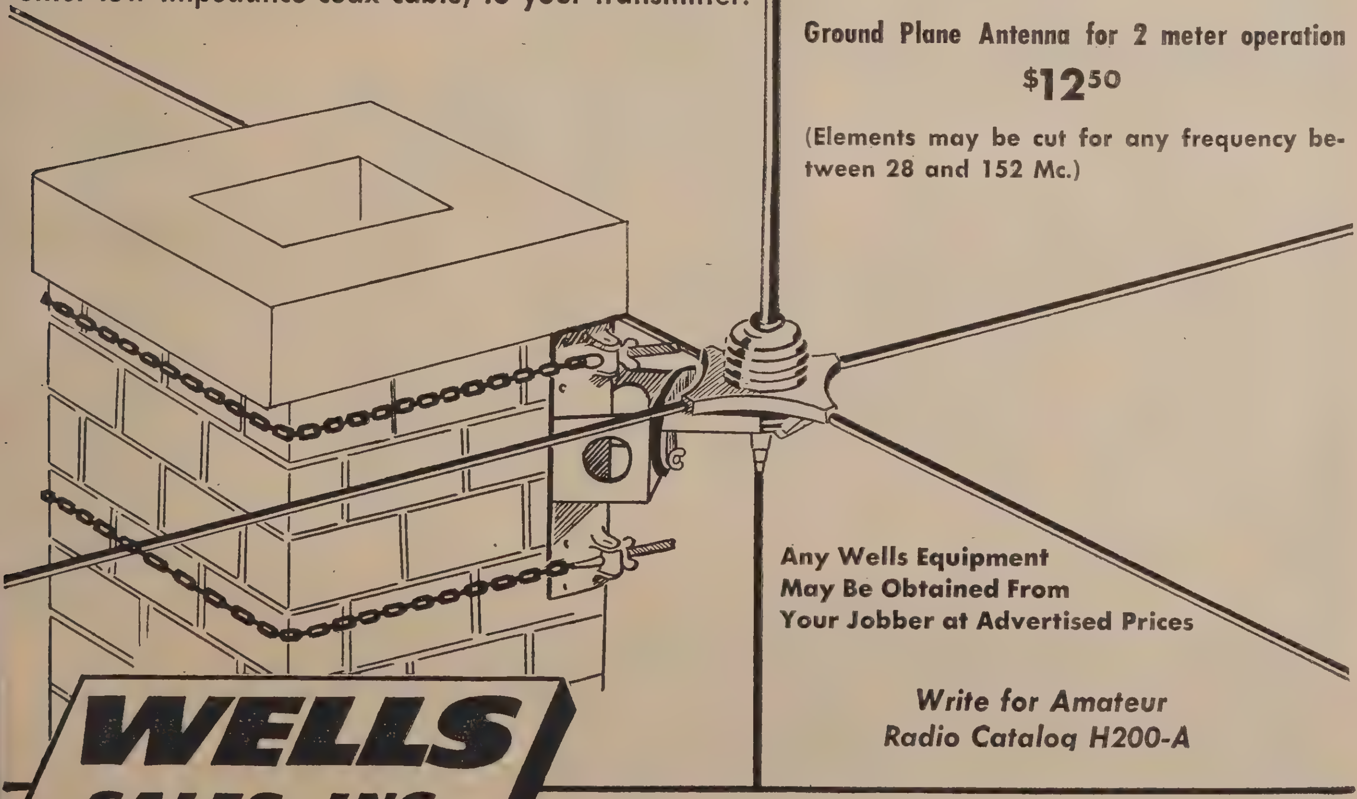
Ground Plane Antenna for 10 meter operation

$\$12^{50}$

Ground Plane Antenna for 2 meter operation

$\$12^{50}$

(Elements may be cut for any frequency between 28 and 152 Mc.)



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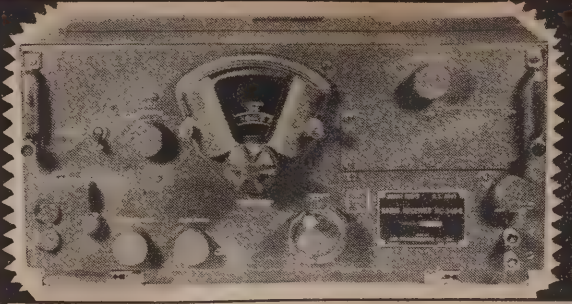
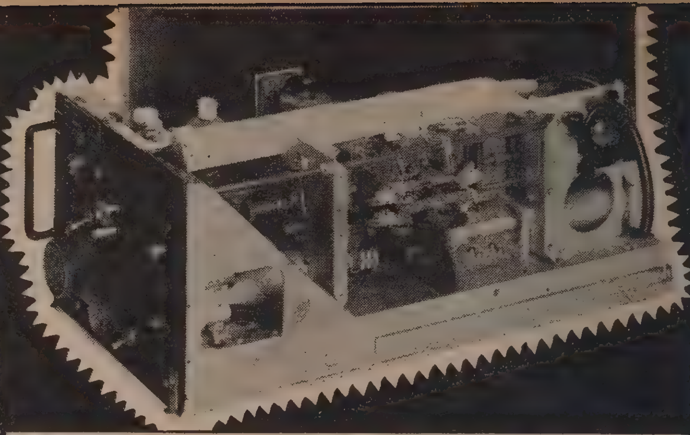


BC-348 COMMUNICATIONS RECEIVER

This receiver will give outstanding performance wherever used. 6 bands, 200-500 Kc. and 1.5-18 Mc. Two stages RF, three stages IF, BFO, Crystal Filter, Manual or AVC. Complete with tubes and 24 V. dynamotor. Guaranteed. In excellent condition.

Price $47.50

BC-348, 110 V. AC Power Supply, including simple conversion instructions, complete with 6x5 tube.. $9.95



RADAR TRANSMITTER T-39/APQ-9.

Contains many excellent parts for the VHF experimenter such as a cavity oscillator using 2-RCA 8012 tubes rated at full output to 500 Mc. Tubes are forced air cooled by 24 V. DC motor, which is easily converted for 110 V. AC operation. Other valuable parts such as a pair of 807's, 2-6AC7, 1-931 and 1-6AG7 tubes; ceramic switch, potentiometers, gears, revolution counter, etc.

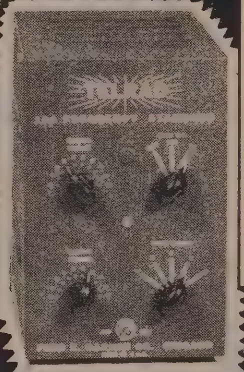
PRICE.. $19.50

TURBO AMPLIFIER

Used for parts—shipped complete with the following tubes

2............7 C 5's
1..... ......7 Y 4
1 .... 7 F 7

Price .... $1.25 ea.



TELRAD 18-A FREQUENCY STANDARD.

Checks signals in the range of 100 Kc. to 45 Mc. with a high degree of accuracy. Self-contained power supply is 110, 130, 150, 220, and 250 V. 25-60 cycle AC. Complete with tubes, dual crystal, and instruction book. Brand new.

Price...................................... $24.95

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Brand New in Original Boxes

1. 0-500 Ma. DC, 3½" Westinghouse	$3.50
2. 0-300 Ma. DC, 2½" Westinghouse	2.50
3. 0-5 Amp. RF, 3½" Westinghouse	4.50
4. 0-7.5 Volts AC, 3½" Westinghouse	3.50
5. 0-3 Amp. RF, 2½" Westinghouse	3.50
6. 0-10 Ma. DC, 0-300 Ma. DC—Combination, 2½" Westinghouse or GE	3.00
7. 0-2 V FS Rect. Type 2000 Ohm/V., Volume Level Meter, 2½" Westinghouse	3.00

BC-375-E TRANSMITTER, $17.50

Transmitter only, including tubes and one tuning unit of your choice.

BC-375 Transmitter Tuning Units in aluminum cases.

TU-5B and TU-10B	$3.95 ea.
TU-6B, TU-7B, TU-8B, and TU-9B	2.95 ea.
TU-26-B	2.45 ea.
Antenna Tuning Unit, BC-306-A	3.95
Dynamotor PE73-C	4.95

BC-357 MARKER BEACON RECEIVER

Ideal for controlling remote circuits for model aircraft, boats, etc. Operates from 75 mc. Signal easily altered to 2 meter band. Tubes used and included: 1—6SH7, 1—6SL7GT, 1—12SN7GT Also sensitive relay. Circuit diagram included inside case. Size 5⅜"x3⅜"x 5¼" For 24 V DC operation. Complete as shown.

Price. $1.95

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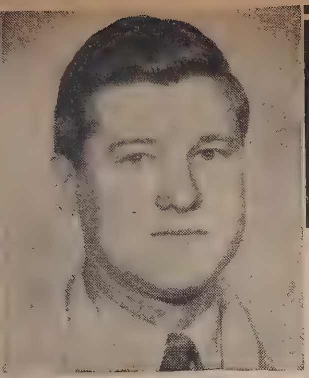
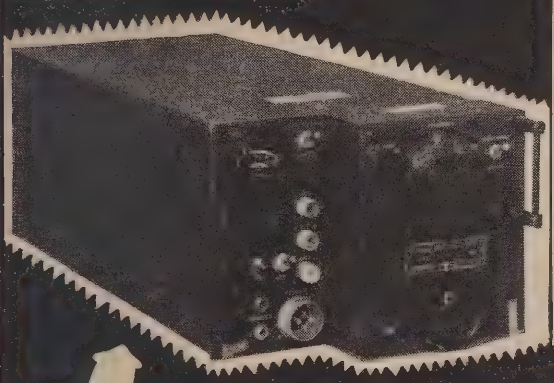


ESSE Specials!

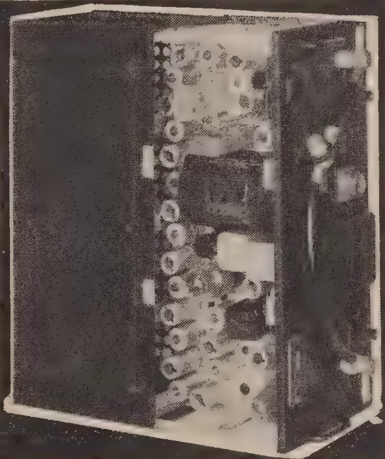
UNLESS OTHERWISE SPECIFIED, MERCHANDISE HAS BEEN REMOVED FROM SURPLUS AIRCRAFT AND IS SOLD AS USED.



RECEIVER AND TRANSMITTER RT-34/APS-13.

Ideal for conversion for amateur mobile use on VHF frequencies. These units are very clean and come complete with dynamotor for 28 V DC input, 285 V. 60 Ma. output, 9-6AG5, 5-6J6, 2-2D21 and 1-VR-105 tubes, co-axial connectors, potentiometers, relay, etc.

PRICE.................................... **$11.75**



R-54/APR-4 RECEIVER.

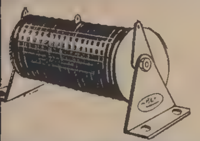
Complete with Tuning Unit TN-17/APR-4 for 74-320 Mc. band. Operates from 115 V 60 cycle AC source.................. **$75.00**

Extra Tuning Unit-18/APR-4 for 320-1,000 Mc. band......... **$17.50**

ARR-1 RECEIVER—34-58 Mc.

Ideal for mobile receiver or converter on 2 or 6 meter band. Contains 4-954 type acorn tubes, connectors, etc.

PRICE **$7.95**



BL-SELENIUM RECTIFIER TYPE 23751

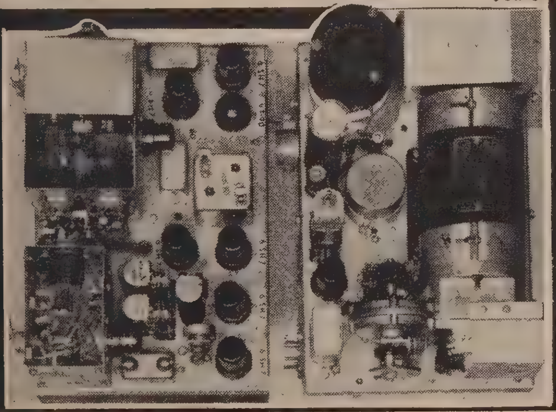
A must for the radio man for the much needed 110 V. DC source. 110-120 V. AC input, 110-135 V. DC output at .75 amp. Connect in parallel for higher current requirements. Size 3⅛x2⅝x1¾ inches.

PRICE—New.................................... **$1.65 ea.**

BC-966-A IFF.

Contains following: Pioneer Gen-E-Motor, 18 V. input, 450 V. 60 Ma. output; 65W-40 ohm resistor; 1 Mfd. 1000 V. condenser; 4-lo-current relays; 4-7193, 7-6SH7, 3-6H6; Eclipse Carbon pile type voltage regulator, etc.

PRICE.................................... $8.75



COLLINS ART-13 TRANSMITTER

Complete with dynamotor and tubes........... **$88.50**

BEAM ROTATING MOTORS

As described in August Radio News. Conversion data included.

PRICE.................................... **$14.95**
Converted.................................... **$37.50**

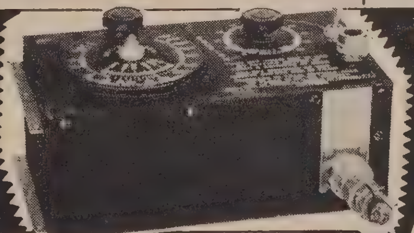
NAVY TDE-2 TRANSMITTERS

Brand new, including tubes..................... **$300** each

HS-30 STETHOSCOPE TYPE HEADPHONES

Lightweight, comfortable to use.

New.................................... **$1.75 pr.**



INTERVALOMETER

Used to release bombs at pre-determined intervals—adaptable for use as a timing device in photography, etc.

Price .... **$1.75** ea.

TERMS CASH WITH ORDER

ESSE Radio Company

130 W. New York St.· Indianapolis 4, Ind.

OPPORTUNITY FOR RADIO MEN!

Think of it! The average American home has at least 11 electric motors in it. Large homes have from 15 to 25—in washers, record players, oil burners, clocks, fans, mixers, refrigerators, etc. No wonder, then, that motor repair is such a good, well-paid business! It's a real "natural" for radio men to learn—and our big new book, ELECTRIC MOTOR REPAIR (see below) teaches you fast—teaches you right! Send coupon today!

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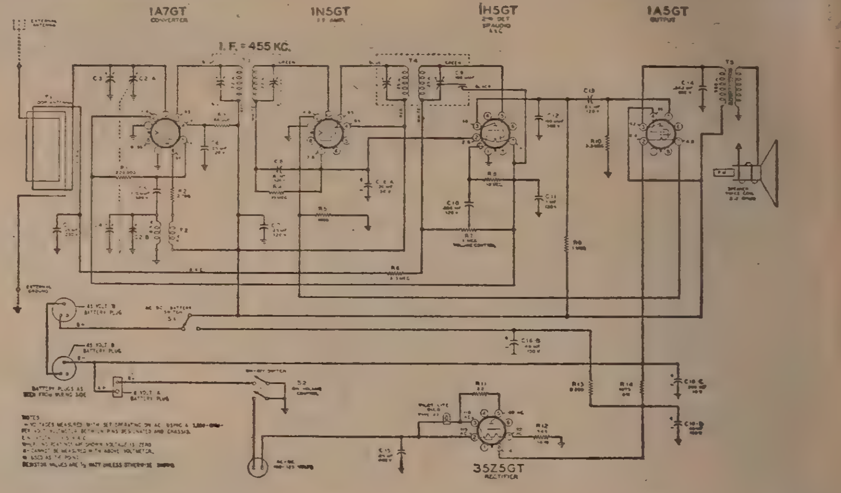
the RN CIRCUIT PAGE

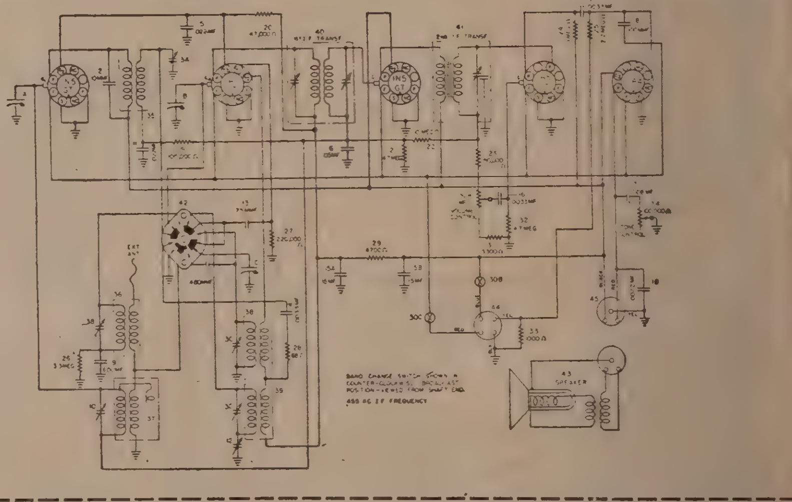
(FOR PARTS LISTS SEE PAGE 84)

RADIO NEWS, SEPTEMBER, 1947 **BELMONT MODEL 5P19**



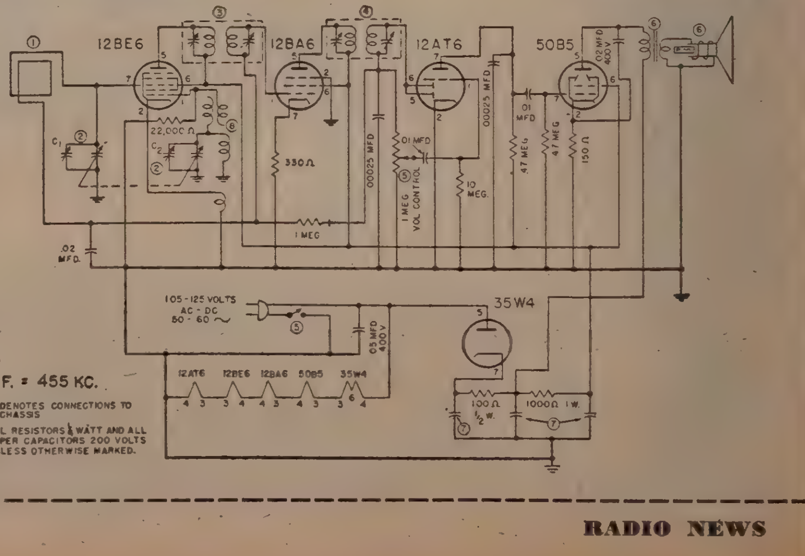
1A7GT
CONVERTER
1N5GT
I.F. AMP.
1H5GT
2ND DET. 1ST AUDIO A.V.C.
1A5GT
OUTPUT
I.F. = 455 KC.
T4
T5
C13
C14
C12
C10
C11
C16-B
C16-C
C16-D
C15
C2 A
C2 B
C3
C8
R2
R5
R6
R7
R8
R10
R11
R12
R13
R14
VOLUME CONTROL
T2
A.V.C.
EXTERNAL GROUND
45 VOLT B BATTERY PLUG
B+
B−
A+
AC-DC-BATTERY SWITCH
S1
ON-OFF SWITCH
S2
6 VOLT A BATTERY PLUG
BATTERY PLUGS AS SEEN FROM WIRING SIDE
PILOT LITE BULB
AC-DC 105-125 VOLTS
35Z5GT
RECTIFIER
SPEAKER VOICE COIL
NOTES
RESISTOR VALUES ARE ½ WATT UNLESS OTHERWISE SHOWN

RADIO NEWS, SEPTEMBER, 1947 **CROSLEY MODEL 56FC**



5
.002MF
20
47,000 Ω
40
1ST I.F. TRANSF.
41
2ND I.F. TRANSF.
1N5 GT
2
34
35
6
.05MF
22
25
7
.0033MF
8
16
.0033MF
32
4.7 MEG
VOLUME CONTROL
TONE CONTROL
42
13
27
220,000 Ω
29
470 Ω
54
53
30B
30C
44
33
1000 Ω
EXT ANT
36
38
26
3.3 MEG
9
37
39
28
480MF
45
43
SPEAKER
BLACK
RED
YEL
BAND CHANGE SWITCH SHOWN IN COUNTER-CLOCKWISE BROADCAST POSITION—VIEWED FROM SHAFT END.
455 KC I.F. FREQUENCY

RADIO NEWS, SEPTEMBER, 1947 **GAROD MODEL 5A1**

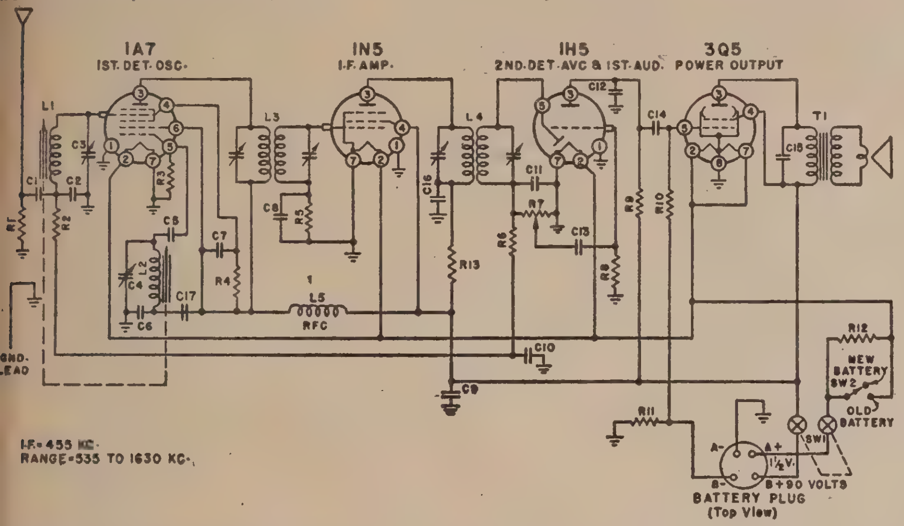


①
②
③
④
⑤
⑥
⑦
⑧
12BE6
12BA6
12AT6
50B5
35W4
C1
C2
22,000 Ω
330 Ω
.00025 MFD
.01 MFD
1 MEG VOL CONTROL
10 MEG.
.00025 MFD
.01 MFD
.47 MEG
.47 MEG
150 Ω
.02 MFD 400 V
1 MEG
.02 MFD.
105-125 VOLTS AC-DC 50-60 ~
.05 MFD 400 V
100 Ω ½ W.
1000 Ω 1 W.
I. F. = 455 KC.
DENOTES CONNECTIONS TO CHASSIS
ALL RESISTORS ½ WATT AND ALL PAPER CAPACITORS 200 VOLTS UNLESS OTHERWISE MARKED.

Here, and on following pages, are circuit diagrams and parts lists of many new postwar radio receivers. Radio News will bring to you other circuits as quickly as possible after we receive them from manufacturers.

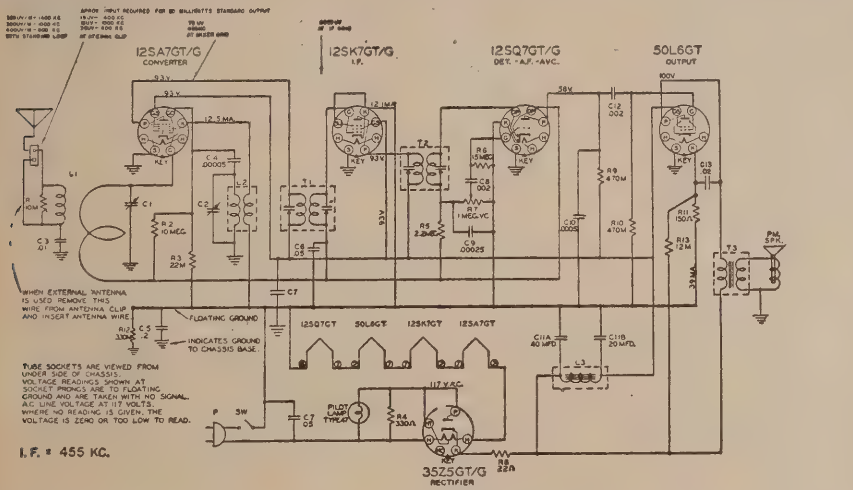
ADIO NEWS, SEPTEMBER, 1947

ADMIRAL MODELS 7T06, 7T12


1A7
IST. DET. OSC.
IN5
I-F. AMP.
IH5
2ND. DET. AVC & IST. AUD.
3Q5
POWER OUTPUT
L1
L2
L3
L4
L5
RFC
T1
C1
C2
C3
C4
C6
C7
C8
C9
C10
C11
C12
C13
C14
C16
C17
C18
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
GND. LEAD
I.F. = 455 KC.
RANGE = 535 TO 1630 KC.
R12
NEW BATTERY
SW2
OLD BATTERY
SW1
A-
A+
1½V.
B-
B+90 VOLTS
BATTERY PLUG
(Top View)

ADIO NEWS, SEPTEMBER, 1947

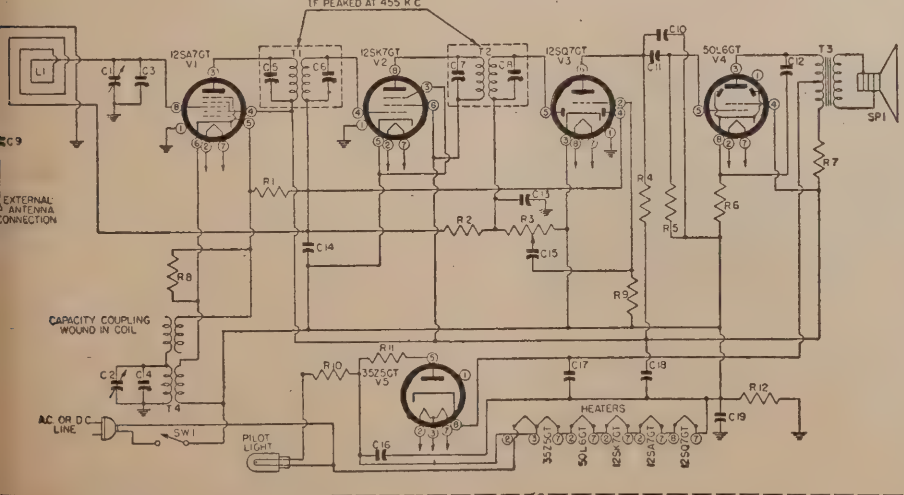
ARVIN MODELS 555, 555A, 552N, 552AN


APPROX. INPUT REQUIRED FOR 50 MILLIWATTS STANDARD OUTPUT
12SA7GT/G
CONVERTER
12SK7GT/G
I.F.
12SQ7GT/G
DET. - A.F. - AVC.
50L6GT
OUTPUT
93 V.
93 V.
12.5 MA.
12 IMA
93 V
93 V
58 V
100V
KEY
L1
R 10M
C3 .01
C1
R2 10 MEG.
R3 22M
C4 .00005
C2
L2
T1
C6 .05
T2
R6 15 MEG
C8 .002
R7 1 MEG. VC
R5 2.2 MEG.
C9 .00025
C12 .002
R9 470M
C10 .0005
R10 470M
C13 .02
R11 150Ω
R13 12M
39 MA
T3
PM. SPK.
C7
WHEN EXTERNAL ANTENNA IS USED REMOVE THIS WIRE FROM ANTENNA CLIP AND INSERT ANTENNA WIRE.
FLOATING GROUND
R12 330M
C5 .2
INDICATES GROUND TO CHASSIS BASE.
12SQ7GT
50L6GT
12SK7GT
12SA7GT
C11A 40 MFD.
C11B 20 MFD.
L3
TUBE SOCKETS ARE VIEWED FROM UNDER SIDE OF CHASSIS. VOLTAGE READINGS SHOWN AT SOCKET PRONGS ARE TO FLOATING GROUND AND ARE TAKEN WITH NO SIGNAL. A.C. LINE VOLTAGE AT 117 VOLTS. WHERE NO READING IS GIVEN, THE VOLTAGE IS ZERO OR TOO LOW TO READ.
P
SW
C7 .05
PILOT LAMP TYPE 47
R4 330Ω
117 V.A.C.
R8 22Ω
35Z5GT/G
RECTIFIER
I.F. = 455 KC.

ADIO NEWS, SEPTEMBER, 1947

EMERSON MODELS 507, 509, 518, 522, 535
CHASSIS MODEL 120005

PART NO. 950004


IF PEAKED AT 455 K C
L1
C1
C3
12SA7GT
V1
T1
C5
C6
12SK7GT
V2
T2
C7
C8
12SQ7GT
V3
C10
C11
50L6GT
V4
C12
T3
SP1
C9
EXTERNAL ANTENNA CONNECTION
R1
C13
R2
R3
C15
R4
R5
R6
R7
C14
R8
R9
CAPACITY COUPLING WOUND IN COIL
C2
C4
T4
R10
R11
35Z5GT
V5
C17
C18
R12
C19
HEATERS
AC OR DC LINE
SW1
PILOT LIGHT
C16
35Z5GT
50L6GT
12SK7GT
12SA7GT
12SQ7GT

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No. 83-275. Complete. *ONLY*......... **14⁹⁵**

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$........ enclosed

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City..............Zone....State..............

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- # 8—Knobs; 25 asstd. set screws, springs & push-button types 1.00
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- # 2—Face 1¼"x1¾"x⅞" high .... .98
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- # 4—Face ¾"x⅝"x⅜" high .... .39
- # 5—Polished, ⅞"x9/16"x⅜" high ..... .35
- # 7—Face ½"x½"x⅜" high .... .10
- # 9—ALNICO V, h'shoe, poles 9/16" sq.; 1½" high .... .98
- #11—H'shoe, poles 11/16" O.D., 2¼" high 1.29
- #14—Plshd. bar, 3x1¼"x⅞" (magnetized lgthwise, wide or narrow sides) 1.29
- #16—Flat bar, 1⅞"x15/16"x5/16" thick .. .49
- #18—Round bar, ¼" O.D. x 5/16" ...... .19
- #22—Rnd bar, plshd. ⅝" O.D. x 1¼" ... .39
- #24—Rnd bar, plshd. ⅝" O.D. x 4¼" 1.25
- #26—Rnd bar, plshd. ⅜" O.D. x 2" ...... .49
- #28—Circular, plshd. 1⅞" O.D., 13/16" I.D., 1½" deep 1.95
- #30—H'shoe, facing ⅜" sq. poles, ¾" gap, 2¼" high .... .89
- #31—H'shoe, extremely powerful. Poles 15/16"x13/16", 2" high. Polished. 1.49

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What's New in Radio

TV TUBE

The Tube Division of the *General Electric Company's Electronics Department* has announced the development of a new ten-inch cathode-ray electronic tube, the Type 10FP4, for use in television receivers.

Employing magnetic focusing and deflecting, the new tube is designed with an aluminum-backed, direct-view screen. In addition to increasing the clarity, brilliance, and definition of the image, this aluminum backing prevents the development of ion spots and intercepts cathode glow, according to the company.

Maximum ratings of the 10FP4 include an anode voltage of 10,000 volts; grid No. 2 (accelerating electrode) voltage of 410 volts; grid No. 1 (control electrode) voltage of minus 125 volts.

Constructed with a small-shell, 7-pin duodecal base, the 10FP4 has an overall length of 18 inches and a maximum deflecting angle of 50 degrees.

Further information on this new Type 10FP4 may be obtained from the Tube Division, *General Electric Company, Electronics Department*, Schenectady, New York.

150 WATT TRANSMITTER

Production is under way at the *Collins Radio Company* plant in Cedar Rapids on the company's Model 32V-1, 150 watt amateur phone or c.w. transmitter.

Housed in a receiver-type cabinet, the 32V-1 is complete including r.f. circuits, audio circuits, and power supply. Frequency control is variable by means of a permeability tuned oscillator. All r.f. circuits are ganged and are tuned by the frequency control knob, with exception of the output coupling network. Bandswitching is employed in all stages.

Collins Radio Company, Cedar Rapids, Iowa will furnish complete details on this amateur transmitter to those requesting them direct from the company.

SIGNAL TRACERS

Two new signal tracers, Model 250 and 200, have been added to the *Precision Electronics, Inc.* line of test equipment.

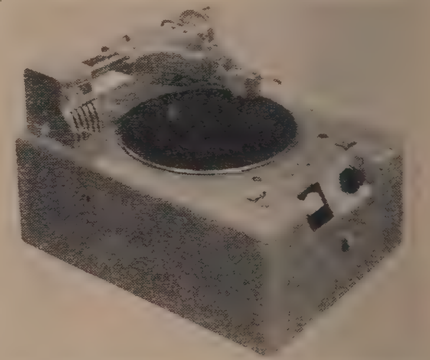
The Model 250 is a deluxe unit which incorporates a four-stage v.t.v.m., provides a gain of 12,000, and an input capacity of 3 μμfd. without detuning effects. The unit is a.c. operated from any 105-120 volt, 50 or 60 cycle line. The frequency range is from 20 cycles to 300 mc.

The standard Model 200 checks signals stage-by-stage in the r.f., i.f., and audio sections. It is similar to the deluxe unit with the exception of the v.t.v.m.

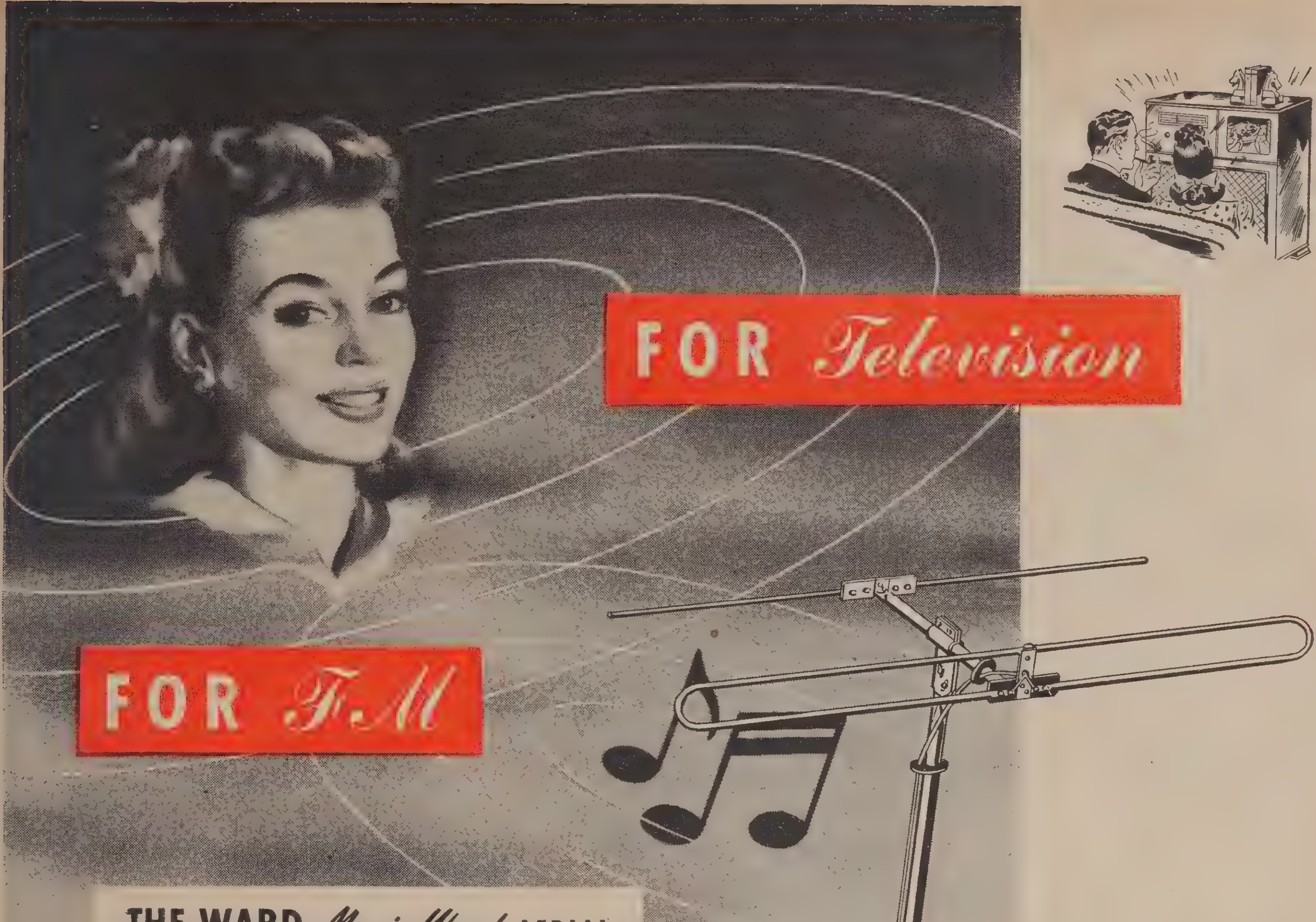
Details on either or both of these units may be secured by writing to *Precision Electronics, Inc.*, 641-643 Milwaukee Avenue, Chicago 22, Illinois.

PROFESSIONAL RECORDER

Robinson Recording Laboratories have announced a new professional recorder which is the result of their eighteen years' practical experience and research in the field.



The recorder chassis is built on a heavy cast aluminum bedplate and features a cast-in control panel for VI meter, fader, and switches. The cutter carriage and pitch change box are of chrome plated aluminum. The cutter carriage is made in two types which will accommodate any existing type of recording mechanism. The standard type accommodates *RCA*, *Presto* and other popular small cutting heads. A second type of carriage is made for *Western Electric* wax cutters. A precise vertical vee-slide block permits accurate adjustment of cutting needle angle, accommodating all cutting needle lengths. The feed screw is ⅞" in diameter and the threads are precision ground. Five pitches are available by means of five levers, pro-



THE WARD *Magic Wand* AERIAL
makes any receiver work better

Scientific tests prove that quality FM or Television reception is difficult, if not impossible, without a good outdoor aerial. So, don't blame your receiver if reception isn't up to par. Do install a Ward Magic Wand Outdoor Aerial and see for yourself the almost magical improvement that results.

These new Ward outdoor FM and television aerials are available in either straight or folded dipoles (reflector kits also available) for the 88 to 106 mc FM band, and the 44 to 88 mc television band. They do away with bothersome weak spots, and your set functions at full efficiency even on distant stations.

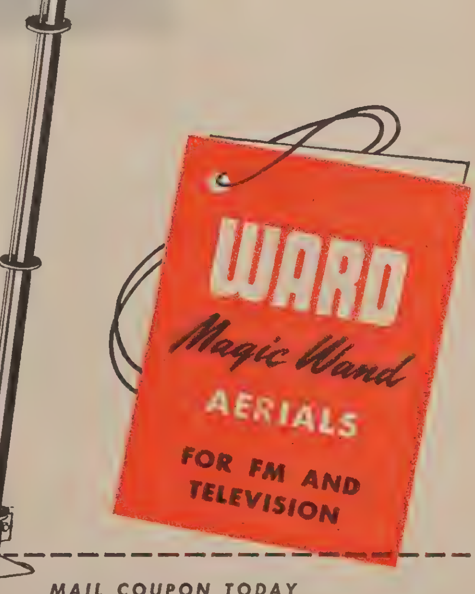
New foolproof design adapts easily to the requirements of each installation. Universal base permits mounting at any roof or wall angle. Sturdy vertical element revolves in base to easily orient dipole for maximum gain. Dipole is of corrosion-preventive aluminum, other parts weatherproofed inside and out. Ring provides for attaching guy wires. Sixty-foot polyethylene-insulated lead-in of 300-ohm colinear transmission line included. Standoffs of exclusive design guide transmission line down mast, and to receiver, minimizing capacity to ground and eliminating line reflections. Complete, step-by-step installation instructions included with each aerial.

Get your Ward Magic Wand FM or Television Aerial today, or mail the coupon below for free catalog and name of your nearest dealer.

THE WARD PRODUCTS CORPORATION
1524 East 45th Street, Cleveland 3, Ohio
DIVISION OF THE GABRIEL COMPANY

IN CANADA: Atlas Radio Corp., 560 King Street, W., Toronto, Ontario, Canada
EXPORT DEPT.: C. O. Brandes, Mgr., 4900 Euclid Avenue, Cleveland 3, Ohio

ATTENTION DEALERS:
Powerful Ward national advertising in the Saturday Evening Post, and leading newspapers, now is educating over 33 million present (and future) owners of FM and television receivers to their need for Magic Wand Aerials. Write for free details on how you can best capitalize on this advertising in your locality.



MAIL COUPON TODAY

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Cleveland 3, Ohio

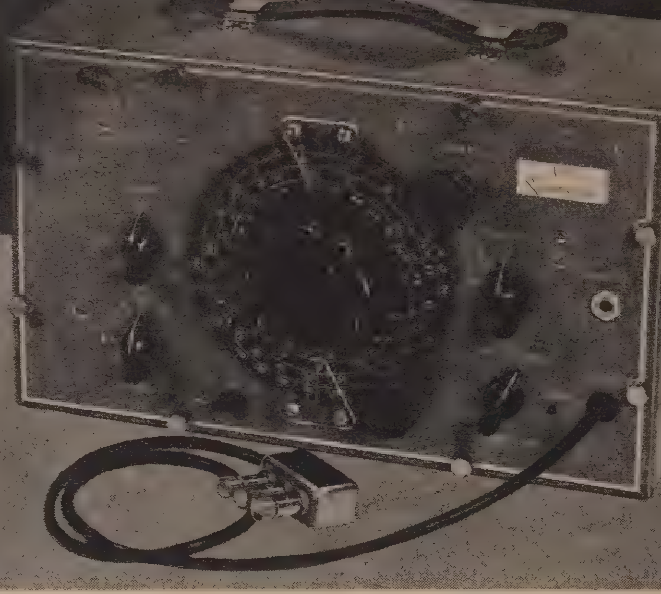
Please send me free catalog on Ward Magic Wand Aerials for FM and Television, and name of my nearest dealer.

NAME______________________________

ADDRESS____________________________

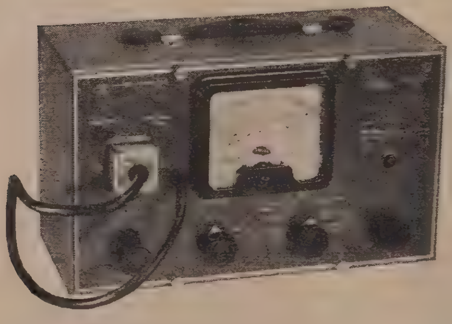
CITY AND STATE_______________________

SILVER AM PLUS FM 90 KC-210 MC



OVERWHELMING ENTHUSIASM greeted first shipments of Model 906 Signal Generator . . most of which seem to have gone into manufacturers' laboratories, so good is it. Nowhere else . . . at any price . . . can you buy its equal. Check these features: eight ranges dial calibrated to ± 1% accuracy . . . 90 kc/170 mc. AM . . . 90 kc-210 mc. FM . . . built-in 0/500 kc. FM sweep . . . variable 400 amplitude modulation . . . *less than 1 microvolt* to over 1 volt metered output . . . resistive and capacity-insulated output strays so low it's in the $500.00 and up laboratory class. Yet price is only $99.50 net.

"VOMAX"



NEW PENCIL-THIN R.F. PROBE

Now "VOMAX" is equipped with new, pencil-thin, flexible 5-inch r.f. probe extension plus ground clip-lead. It will reach any point in the tightest midget receiver . . . will even bend around corners! This exclusive new SILVER development maintains "VOMAX" as the finest, most complete meter you can buy . . .
Overwhelmingly, acceptance proves "VOMAX" to stand head and shoulders above any other meter — at any price. It is unbeaten . . . even by its copyists . . . for accuracy, for d.c., a.c., a.f., i.f. and r.f. voltage ranges . . . as it is for current and resistance ranges . . . for frequency range . . . and for that astronomically high input resistance so necessary to effective AM, FM, and TELE receiver servicing. Price is still only $59.85 net . . . r.f. probe extension kit $.35.

NEW CATALOG: Mail penny postcard for complete catalog these and other SILVER top-dollar test instruments. They are the back-bone of modern servicing. New transmitters, receivers, exciter, MICROMATCH, pretuned frequency multiplier are amateur news! See them at your jobber.

OVER 36 YEARS OF RADIO ENGINEERING ACHIEVEMENT

McMurdo Silver Co., Inc.

1249 MAIN ST., HARTFORD 3, CONNECTICUT

viding 85, 100, 120, 130, and 140 lines per inch. Selection of outside in or inside out recording may be made instantaneously by means of a toggle lever. Another toggle lever changes the turntable speed from 78 to 33⅓ r.p.m.

A constant speed motor is suspended from the underside of the chassis. The chassis fits in two styles of steel cabinets, one for portable use and the other for operation in a fixed location.

Complete performance data on this recorder will be supplied by *Robinson Recording Laboratories*, 2022 Sansom Street, Philadelphia, 3, Pennsylvania.

SIGNAL TRACER KITS

Students, servicemen, amateurs, and experimenters who like to build their own test equipment are being offered two new and complete kits of parts for assembling either a battery operated or an a.c. operated signal tracer by *Special Products Company* of Silver Spring, Maryland.

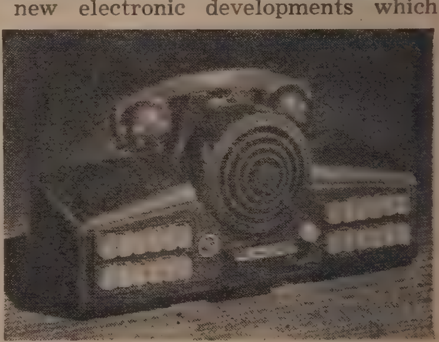
These kits contain parts identical with those used in the completed models offered by the company. All components are packaged in individual envelopes or are tagged for accurate identification by the assembler. Circuit diagrams, assembly pictorials, instructions for assembly, and an operating handbook are included with each kit.

The battery operated tracer kit is known as the model "Stab-Kit" while the a.c. operated kit is known as the "Stac-Kit." Information on either or both of these units will be furnished by *Special Products Company*, Silver Spring, Maryland, upon request.

NEW AMPLICALL

Rauland Corporation of Chicago has announced a new type of intercom system, the "Amplicall."

Housed in a modern case of walnut plastic, this unit incorporates several new electronic developments which provide versatile operation and economy of installation, according to the company.



The master station unit is available with or without handset (for completely private conversation). The unit features a visual-type busy signal, individual locking-type push-buttons for station selection, illuminated "on-off" volume control, plug-in cable connections, and a balanced line wiring system which prevents cross talk and reduces installation costs.

"Amplicall" systems are available

(*Continued on page* 128)

"TAB"

• NEW GUARANTEED **ELECTRONIC PARTS •**

That's A Buy

USED S.C. & NAVY EQUIPMENT "TAB" GTD I-222 XTAL CALIB SIG-GENERATOR, FREQ METER, MONITOR, OP 110V/60cy complete Covers IF ranges FM & TELEVISION, DUAL OSC. 8to15&45to 77mc's; 2nd,3rd&4th harmonics usable to 230mc's. SIX Tubes micro-Vernier dial reads 1/10 div. Rugged Dsgn SPECIAL.	$45.00
NAVY SOUND POWERED TELEPHONES	9.95
SCR 522 COMPRISES BC624&625 RECEIVER TRANSMITTER 100-156mc's COVERAGE XTAL CONTROL XMITTER MODULATED 15W OUTPT RCVR 10 Tubes, XMITTER 7tubes Complete with data for Amateur use	18.00
NAVY RBC RECEIVER 4 to 27 mc's 16 tubes BEST RECVR MADE SPECIAL.	75.00
BC1073A-VHF WAVEMETER SIG-GENERATOR OP 110VAC, Range 150-210 mc's/19 tubes can be converted to receiver SPECIAL	24.95
CW3 RCVR NEW COMPLETE & Data for Converting into Ham Rcvr	14.50
CW&F3 Coils 5.1-10 or 9.4-16.5mc's	2.70
AIRCRAFT AUTOSYNS AY-1&5/28V/400 cy can be used 24V/60cy used gtd. TWO for	3.95

GE THERMOSTAT adj 70to170°F/250V/25AMP	$3.95
WSTGHSE RECTIFIER FW 12V/2AMP	3.95
WSTGHSE RECTIFIER CT 9V/0.2AMP..2 for	1.49
IT&T SELENIUM RECT 110VDC/2.6AMP	5.95
IT&T SEL RECT 6B8AVI, FW 85V/2.4AMP	6.95
IT&T SEL RECT 6.5Vin/2.2V/1.5Amp	1.49
BLOWER AIR 100cuftM 28VDC & AC Inpt	4.95
BLOWER AIR SAME OPERATES 115VAC/60 cy	5.95
VACUUM CONDSRS 50MMF/7500V GE	3.95
VACUUM CONDSRS 100MMF/7500V GE	4.95
VACUUM CONDSRS 50MMF/20000V JEN	6.95
RAYTHEON VOLTAGE REGULATOR adj V inpt taps 95to130V/60cy; outpt 115V/.58 AMPS one half 1% REGULATION: wt. 20 lbs 6⅛H 8¼L 4-⅝"W. Rugged dsgn. SPECIAL	10.95
HVI-DUTY VOLTAGE REGULATOR INPUT TAPPED 198to242 Volts 50/60cy; OUTPUT 220VOLTS/500WATTS: One Half 1% Regulation—RAYTHEON new S.C. D'sgn rugged Construction wgt 70 lbs, size 18-¾L 8W 9½"H Relay Rack mtging SPECIAL	39.95
TRANSTAT 88-132V/18.2AMPS VARIABLE	29.95

WRITE TAB FOR S.C. TECH-MANUALS

WSTGHSE "DB"MTR3½" SQB'C —10+6DB.	$4.95
WSTGHSE 3½" SQ BKL CASE 0-1ma RX35.	4.50
DEJUR 2½" B'CASE 0-1ma STD SCALE	2.95
GE RF MTR 2½" B'CASE either 1 or 5AMP.	3.95
WESTON 476 AC 15VOLTMTR 3½" SQ B'Case	4.95
WESTON 506MTR —10plus6DB 2½" B'Case	4.50
GE DW54 MTR —10plus6DB 2½"B'Case	3.95
GE DO40/3½"B'C 2.5&25ma 0 ctr Galvo	3.95
GE DW41 MTR 2000V/1000ohmperV 2½" B'C.	5.95
GE AO22 MTR 0-150VAC 3½" B'C	4.95
McCLINTOCK 3½" B'C 0-1ma Meter	3.95
WSTGHSE DUAL 200microma no 0 adj	1.95
WESTON 506 MTR 250ma 2½" B'C	3.25
WSTGHSE 2½" B'C 30Volts AIRCRAFT	2.75
SPEECH AMPLIFIER ART13 COLLINS. Line carbon or Dyn Mike; Output to PP class B Grids. Chassis includes inpt transf & 1st Audio, 6V6 sidetone adj AudioOsc AMP & Hdphone jack Wt 51 lbs. 7-⅛L 3½W 5"H less tubes & pwr supply includes instructions. SPECIAL	4.95
WITH TWO 6V6 & 6SJ7	7.49
GE Voltage Control Relay PJV/115V/60cy SP self reset Calib 70/85/110/160V NEW	5.95

NEW GUARANTEED

DYNAMOTORS

ALL BRAND NEW

"Tab" Specially Priced at a Fraction of Their Original Cost

WRITE FOR QUANTITY PRICES

Can be used as motor or dynamotor

S. C., NAVY AIR CORP SPECIF

MODEL 5053

Mfgrd A. G. Redmond

W. E. Stern Electric KS-5868-L03

Input	Output	Duty
28VDC 1.4Amp.	250V 60ma	Continuous

Wgt—2 lbs.
Qty 1800

"TAB" SPECIAL PRICE
$1.85

Works as 110VDC Motor
Can be used on 12VDC input by paralleling field coils.
Air Corps Dy.-2B/ARR-2

★ ★ ★ ★ ★ ★

GENERATOR

MODEL G101

Mfgrd Fractional Motors

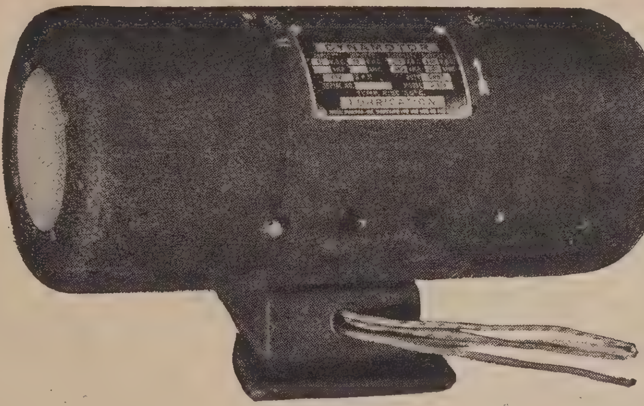
Input	Output
3/16 HP Motor	430VDC
RPM	180ma
3450	Duty-Continuous

Dim. 8"L 5"Dia/SHAFT 2⅜"x½"D

Wgt—17 lbs.
QTY 200

"TAB" SPECIAL PRICE
$8.95

Can be used as DC 110V Motor



Illustrated Unit

S. C. DM-4 Model D104

Mfgrd Fractional Motors

INPUT	RPM	Duty	Output DC
12 or 24 V DC	4000	Continuous	225Volts/100ma 440Volts/200ma

Wgt. 21 lbs. Dim. 11" L 5" Dia. Qty., 1500

"TAB" SPECIAL PRICE
$6.75

MODEL DA-3A

Mfgrd Bendix & Webster

INPUT	RPM	Duty
28VDC 10.5Amp	4700	Continuous
Output #1	Output #2	Output #3
300VDC 260ma	150VDC 10ma	14.5V 5Amp

Wgt—21 lbs. Dim. 12½" L 5" Dia., Qty. 1500

"TAB" SPECIAL PRICE
$3.85

★ ★ ★ ★ ★ ★

MODEL PE-94A

Mfgrd Bendix MG-1A

Aircraft Completely Cased
Input & Output Filters, Voltage Regulators & Relays

Input	RPM	Duty
24-28VDC 13Amps	6000	Continuous
Output #1	Output #2	Output #3
300VDC 260ma	150VDC 10ma	14.5A 5Amp.

Wgt—34 lbs.
Qty. 100

"TAB" SPECIAL PRICE
$9.95

CHOKE GE 12Hy/300ma cased	$2.95
KENYON CHOKE 20Hy/300ma or 15Hy/400ma Cased 15000V insulation wt 40 lbs	7.95
CHOKE 20Hy/100ma cased SPECIAL	.98
STROBO FLASH Transf 1540V/115V/60cy	4.95
HICKOCK 4" SQ Tube Tester Meter	6.95
PRECISION 1% Wirewd Onemeg resistors 90c @ 3 for	2.00
1.8meg,.2.0,4,5,5.0,10Meg/1% H.V. SIX for	3.00
WE DYNAMIC MIKE 20ft CABLE	7.95
8mfd/660VAC/2000WVDC @$3 FOUR for	8.95
2mfd/3000WVDC $4; 4mfd/3000WVDC	5.00
2mfd/5000WVDC $10; 4mfd/5000WVDC	15.00
1mfd/10000WVDC $20; 1mfd/25000WVDC	75.00
RCA 808; 446/2C40/2for$5; 304TL 2 for	7.81
450TL/$29; 807/95c; 813/$6.95; 815	2.19
845/$3.75; 829B/3E29/$2.90; 954/50c@ 5 for	2.00
5BP1,5CP1,5BP4/$3.55@; 3BP1 & SOCKET	2.99
955,56,57,58A,59 & Socket/90c@; 2C26	.75
1625/65c; 2V3G/75c; 872A & SOCKET 2 for	5.40

SEND ORDERS FOR ALL TUBE REQUIREMENTS

Tubes guaranteed exception breakage & Open Fil. WRITE FOR TUBE, PRECISION RESISTORS & CONDENSER LIST

FREQ METER MANUAL SCR211 S.C. 1.00

UTC 8Hy/150ma NEW cracked Bake T'Bd	$0.89
866A Combination transformer, 2sockets&tubes	5.95
TRANSFORMER ONLY FOR TWO 866A TUBES	3.95
872A Combination Transformer, 2sockets&tubes	12.00
872A Transformer 115V/60cy	6.95
CRYSTAL DIODE TEST SET 268U NEW	15.95
CRYSTAL DIODE IN34 @ $1.39 TWO for	2.40
CRYSTAL DIODE IN21 @ 45c THREE for	1.00
CRYSTAL DIODE IN26 @ $1 TWO for	1.50
CRYSTAL STD 200KC/0.1%accy Vacuum	5.95
CRYSTAL STD 7010KC/0.1%accy TWO for	1.00
Vacuum Xtals GE 93.12 or 81.95KC ea	2.95
HANDIE-TALKIE BC611 Chassis, Coils, X	7.95
TRANSF 115 or 230V/50-60cy/1400Watts Csd.	19.95
Auto transf 115/160/170/180V;60cy Cased	2.95
IF STRIP 30mcs/85DBgain 8/6AK5 & 1/6AL5 2x11x2⅜"H/12mcs bnd width, outpt Jack & COAXIAL inpt plug ideal IF STRIP TELEVISION	9.49
TRANS Modulation PP parallel 6L6's or 807's to PP RF 807's/2000ohm load	2.95
Trans 115V/60cy 7.5V/12Amp H.V. Choke Swinging 15-29Hys/150ma	2.95

$2 Min. order FOB N.Y.C. Add Postage all orders and 25% deposit. Worth 2-7230. Send for catalog 99. Specialists in International Export, School, College & Industrial trade. Money-back "TAB" Guarantee.

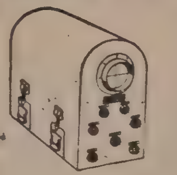
KIT SPAGHETTI SLEEVING ASSTD 75ft	$1.00
KIT HARDWARE GOOD ASSMNT ONE LB	.99
KIT GROMMETS RUBBER 100 ASSTD	.99
KIT MOTOR BRUSHES 100 ASSTD	1.00
KIT FUSES ASSTD BUSS & L.F. 300 for	1.95
KIT KNOBS ASSTD WITH BUSHINGS 25 for	1.25
KIT ROTARY SWITCHES SIX for	1.75
KIT POWER RHEOSTATS 25 & 50 WATT 6 for	4.95
KIT WW RESISTORS 20 for	1.00
KIT RESISTORS ½&1W/50to2megs 100 for	2.50
KIT CONTROLS 50—2Megs POTS AB/J 10 for	2.50
KIT SILVER & MICA CONDENSERS 50 for	2.00
KIT LUGS GOOD ASSMNT 100 for	1.00
KIT ELASTIC STOP NUTS ASSTD 75 for	1.00
KIT SOCKETS OCTAL, LOCTAL etc 50 for.	2.95
KIT G&P Tube Grips ASSTD 50 for	1.00
KIT RADIO SOLDER 2 lbs	.98
AUTOSYNS TYPES5/115V/60c NEW 2 for	18.00
AUTOSYN Type5/SynchroDifferential	6.95
AUTOSYN BENDIX TYPE 2/115V/60cy 2 for	18.00
AUTOSYN TYPE5/50V for 115V/60 c 2 for	8.95
AUTOSYN 50V Synchro Differential	3.95

FOR AUTOSYNS—SELSYNS—MAGNESYNS C "TAB"

"TAB" • Dept. 9RN, Six Church Street, New York 6, N. Y., U.S.A. • "TAB"

THAT'S A BUY • • • CORNER CHURCH & LIBERTY STS., ROOM 200 • • • THAT'S A BUY

BRAND NEW—BC-612 OSCILLOSCOPE $49.95



BC-612 Oscilloscope. Brand new factory cartoned. weight 200 lbs. This unit is the most ideal war surplus scope. Works on 110v 60 cycle AC. Only simple changes (conversion in many radio magazines) necessary to convert to a laboratory test scope. Has twin heavy duty plate supplies and tubes 5BP4 5" scope tube, 6—6L6, 2X2, 5T4, 2—6SJ7, 6SC7, 6H6, etc. Schematic diagram with each unit. This may be the last time we have a scoop in a scope like this. Net..........**$49.95**

NAVY ARB RECEIVER, $19.95

You can convert this over, easily to a good ham receiver. It's one of the hottest values in surplus receivers. 28 volts DC input. Covers 4 bands. 195 kc to 9 mc. This is a deluxe type superhet receiver, note that the frequency coverage includes the standard broadcast band. Has 4 gang tuning condenser; can be converted to a 110 volt AC receiver. Priced complete with tubes: 12SF7, 12SA7, 3-12SF7 and 12A6. Has dial built on front of chassis. Electric driven or manual band change switch. Weight 28 lbs. Size 6x7x15 inches.

ARB Near new condition, with tubes and dynamotor.........Net	**$19.95**
ARB Brand new, factory cartoned, with schematic...........Net	**39.95**

New remote control for ARB. **$12.00** extra.

GLIDE PATH RECEIVER, $9.95

R-89/ARN-5 Glide Path Receiver 11 tube superhet. Formerly used for blind landing. Adaptable for many uses. Receives 326 to 335 MC. Contains six relays. 11 tubes 7—6AJ5, 12SR7, 2—12SN7, 25D7. Size 13x5x6. Weight 12 lbs. A beautiful piece of equipment. Has three crystals. Priced complete with xtals and tubes.

R-89/ARN-5 Near new condition ....Net	**$ 9.95**
R-89/ARN-5 Brand new, factory cartoned ....Net	**14.95**

VEEDER-ROOT METER AND CASE

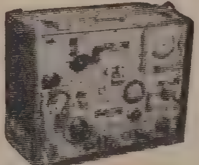
Counts number of feet of trailing wire antennae; number turns when winding on coil; applicable for many uses; beautiful bakelite case, jeweled dialite, pilot light enclosed, 3 position switch, counts up to 1000.
Each **95c**

KEYS—49c

Brand new keys.
Factory cartoned.
While they last,
$0.49 each
10 for $3.95

BC-654 TRANSMITTER RECEIVER $12.95

GUARANTEED TO BE IN GOOD CONDITION

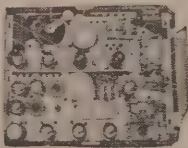


7-Tube Superhet Receiver and 6-Tube Trans. with 25 Watts Power.

Order Now at this Scoop Price. Covers 3800 Kc. to 5800 Kc.

Portable voice and CW transmitter and receiver for portable, mobile, and fixed station operation. 7-tube superheterodyne receiver with 3.5 microvolt sensitivity on voice and 0.5 microvolt sensitivity on CW, and 100 milliwatts undistorted power output. 455 KC IF. Uses 3—1N5GT, 1—1A7GT, 2—3Q5GT, 1—1H5GT tubes. 6-tube transmitter, with antenna tuning network, Colpitts thermal compensated oscillator, class C final with 2—307A tubes in parallel, and crystal oscillator for checking frequency every 200 KC. 25 watts output on CW and 11.2 watts output on voice. Frequency range, transmitter and receiver, 3800 to 5800 KC. Ideal for Hams! Comes complete with cover; furnished with all tubes necessary for the operation of the trans. and rec. lights. Less power supplies. These units are used but in good condition. Shipping weight 50 lbs. ....**$12.95**; 2 for **$25.00**
Send your order to our Kansas City store. This unit will be shipped from our Chicago warehouse. Immediate delivery. You can hardly tell they are used.
BC-654 Less all tubes and crystal...**$7.95**

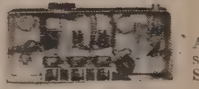
BC-645, $14.95 Each Two for $29.00



Made by General Electric. Factory printed Conversion Diagram. New, factory cartoned. 15 tubes. Covers 450 mc.

ARMY BC-645 I.F.F. UNIT. Early in the war when radar picked up a plane, there was no way of knowing whether it was friendly or not. That was before BC-645 was invented. BC-645 sent out a signal that identified the plane as American. It probably saved more lives than any other piece of electronic equipment made. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham hand 420-450 mc., citizens radio 460-470 mc., fixed and mobile 450-460 mc., television experimental 470-500 mc. Equipment capable of doing the jobs of the modified set sells for hundreds and hundreds of dollars. The 15 tubes alone are worth more than the sale price. 4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955 and 1-WE316A. It now covers 460 to 490 mc. Each BC-645 is shipped with a Belmont factory printed conversion diagram, showing how to make AC power supply modulator and how to make Transmitter and Receiver changes. Most Hams and experimenters already have the few parts necessary. New BC-645 with tubes less power supply. Shipping weight 25 lbs. Extra WE316A Tubes $1.29 each. 12 Volt Dynamotor **$4.95**

SWITCH-POT. SALVAGE, 99c



A real salvage scoop. Has 3 toggle switches, 1 band switch, 6 standard size carbon controls, knobs, etc. Scoop price **.99**. 3 for.......................**$2.50**

BC-1366 Jack Box 11 bank banana plug jack and socket with 5 position single deck switch and control. 2 phone jacks. Scoop price **.59** 2 for **$1.00**

SCOOP, $1.99

Heavy Duty Vibrator—Made for 6-110 volt amplifiers. Freq. 60 CPS. Scoop price..**$1.99**
135 ma 6-110 volt conventional power transformer, with all windings; will run phono motor **$5.95**
(Use with above vibrator.)

LS-7, $2.95

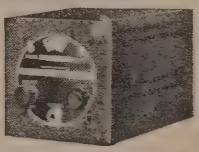
Army LS-7 speaker—Heavy Duty Alnico 5 PM. Works on BC-654-a and other receiver. Net..**$2.95**

BOX SCOOP 79c

ARMY SPARE PARTS BOX. Handy for tools or fishing tackle etc. Has water tight hinged lid. Made of ⅜ water proofed plywood. Size 3 x 11 x 5½. Scoop Price **79c**

NEW BC-1206 $7.95

Setchell Carlson Radio Receiver BC-1206C



Designed to receive A-N beam signals. 24-28 vdc. Tube complement: 14H7, 14A7, RF amplifier 14H7, 14J7 mixer, 14A7, 14H7, IF amplifier; 14R7, detector and 1st audio amplifier; 28D7, output amplifier. 195 to 420 KC 4" high x 4" wide x 6⅝" long. Weight 4 lbs.
Brand New in Original Cartons..**$7.95**

Small Universal output transformer	**$0.89**
Medium Universal output transformer 6 watt..........	**.99**
40 mil 6.3, 5 and h.v. power transformer	**1.99**
55 mil 6.3, 5 and h.v. up-rite pwr. trans.	**2.49**
2 gang .000365 condenser.......	**.99**
Same with cut section 456......	**.99**
Small loop antenna............	**.39**
Oscillator coils	**.19**

AM-26 $1.49

INTER-PHONE SALVAGE SCOOP

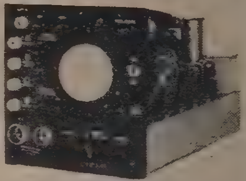
AM 26 interphone amplifier. This unit is nice for parts salvage and the aluminum case is usable for receiver building etc. Size 9½x4½x5". Has two transformers, four tubes sockets, three filter condensers, three position panel switch, toggle switch, and many small parts. All are in perfect condition.
$1.49; 2 for **$2.49**

4000 ohm head-phones. Civilian type, with standard 5-foot cord. Finest type made by Trimm. Scoop Price..**$1.69**

R65 SCOPE, $29.95

Another receiver indicator unit; with gobs of material. Complete with 28 tubes such as: 6SA7, 6SK7, 6H6, 2X2, 5Y3, etc., plus 3BP1 scope tube. A multitude of controls, RF coils, switches, etc. All are in perfect condition; just removed from aircraft. Case size, 9x12x16". Ideal to convert to test scope and beautiful for general salvage. Weight 35 lbs.
Scoop Price **$29.95**

BC929 RADAR, $14.95

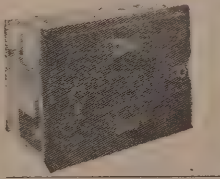


BC-929 A Radar Indicator Scoop. This unit could be rebuilt into a fine test scope. It is an ideal size. 8x9x14 priced with tubes 2—6SN7, 2—6H6, 6G5, 6X5 and 2X2. This is a red hot buy. However you will have to change the power trans. for 60 cycle use. Guaranteed to be in good condition.
Scoop Price **$14.95**
Weight 20 lbs. Has 3 in. Cr Tube.

NAVY SALVAGE SCOOP! $3.95

Navy model ZA Glide path receiver. Has 3—6C6 tubes; several controls, transformer and handy case; size 6x7x12 inches. Ideal for salvage, near new condition **$3.95**. 2 for.......**$6.95**

SCR-522 TRANS. REC., $19.95



SCR-522 You are all familiar with this 100 to 156 MC Transmitter, receiver. These 522's that we have are in rough looking cases and some of the outside connectors have been damaged. However, we guarantee that if you separate the transmitter and receiver and remove the case, you will have usable merchandise. There are not many more of these units available; we have just 100 to sell.

PACKARD BELL PRE-AMP., $1.99

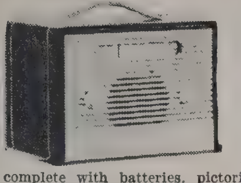
Housed in a handy aluminum case 5x4x5, priced complete with tubes 6SL7, 28D7, has many usable parts. Relay and control PL68 plug and patch cord.

McGEE RADIO COMPANY

WRITE FOR CATALOG

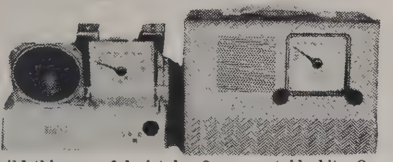
SEND 20% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

PERSONAL PORTABLE KIT, $10.95



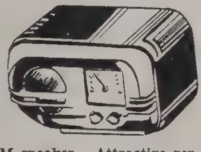
PERSONAL PORTABLE KIT MODEL K-PX. Small size leatherette covered case 8x6x7. Easy to build. Operates on self contained B and A batteries. Rec. Broadcast 550 to 1600 K.C. Incorporates a standard superhet circuit with avc. Has 3 inch Alnico five PM speaker. Priced complete with batteries, pictorial diagram and tubes 1R5, 1S5, 1T4 and 3S4. Not AC DC, but straight battery operated. Has 2 gang cond. Everyone should have one of these personal portables. Everything furnished. Kit K-PX ....Net **$10.95**

3-WAY PORTABLE KIT, $17.95



Build this powerful, 4-tube, 3-way portable kit. Operates on 110 volts AC or DC or self contained batteries. Receives broadcast 550 to 1650 K.C. Incorporates a standard superhet circuit with AVC and loop Ant. Has Alnico 5 PM Speaker, 2 gang condenser. All Parts and batteries are furnished including tubes Disc Rectifier, IR5, 1T4, 1S5 and 3S4. Has attractive leatherette portable cabinet size 7x9x9. Weight 14 lbs. Kit model 3-ZA ....Net **$17.95**

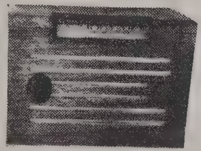
BEAUTIFUL PLASTIC KIT $9.95



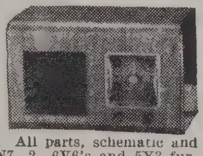
Kit Model P-85. We have finally been able to achieve our goal. Here it is. A good 5-tube broadcast AC DC superhet radio receiver for less than ten dollars. The beautiful 10 inch plastic cabinet is made of the finest material. The chassis is of the standard accepted superhet design. 456 KC ifs AVC and 5 inch Alnico 5 PM speaker. Attractive vernier dial. Two gang tuning condenser. Loop ant. We defy anyone to offer a better working AC DC receiver kit. Priced complete with diagram, photos and tubes 12BE6, 12BA6, 12AT6, 50B5 and 35W4. Nothing else to buy. You can't go wrong on this value. Kit Model P-85 ....Net **$9.95**

SUPERHET. 4-Tube, 1½—90 Volt FARM RADIO KIT complete, less 1000-hour battery; similar cab. to Model P-85. Model PB-48..............Net **$9.95**

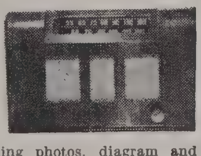
NEW SUPER MIDGET KIT, $12.95
MODEL KP-T



Build this new super Midget Broadcast Radio. Has beautifully made, highly polished walnut cabinet. Size 7½ x 4½ x 5½. Attractive slide rule dial. Incorporates a standard superhet circuit with 456 KC IFS & AVC. Has 2 gang condenser and loop ant. Every part including Alnico V. P.M. speaker and tubes. 12BE6, 12BA6, 12AT6, 50B5 & 35W4. Furnished as well as photo and easy to follow diagram. Weight 5 lbs.



KIT K-7A. Easily assembled into a fine working, attractive, transformer type AC, broadcast receiver; 550 to 1700 KC. Has push-pull audio, tone control and 6½" Alnico 5 PM speaker. Beautifully made 14" walnut cabinet. Incorporates a standard superhet circuit, with AVC and loop antenna. All parts, schematic and tubes 6SA7, 6SK7, 6H6, 6SN7, 2—6V6's and 5Y3 furnished. Has full 90 mil. power trans. Weight 17 lbs.
Dealers Net **$19.95**

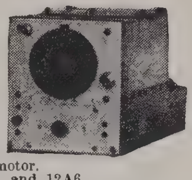


Deluxe AC Kit, $14.95. Model JD5 AC. Has beautifully made 12" walnut cabinet. All parts furnished to build a powerful broadcast 5 tube AC, power transformer type, superhet. Rec. 440 to 1700 KC. Slide rule dial, 2 gang tuning cond. Loop aerial. Heavy duty Alnico V. PM speaker. Everything furnished including photos, diagram and tubes. 6SA7, 6SD7, 6SQ7, 6K6 and rectifier.
Kit JD5 AC. Net..........................**$14.95**

20-WATT UTILITY AMP. KIT, $17.95

Build this 20 watt utility 110 volt AC, 20 Watt power amplifier. Ready punched aluminum chassis, size 12 x 6 x 2½ inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain, for crystal or dynamic mike. Has bass and treble controls. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts, controls, transformers and easy-to-follow diagram furnished, including tubes: 2-6SN7, 6J5, 2-6L6GA, 5Z3. Kit Model 20-LX. Net.....................**$17.95**
12" 12 watt Alnico 5 PM speaker, $6.95 extra. Astatic crystal mike and desk stand, $7.95 extra.

COMMAND RECEIVERS



The Army Aircraft Receiver BC-454 covers 3 to 6 MC. Has 3 gang tuning condenser and two stages of 1415 KC. intermediate frequency. By removing plates from the gang and re-winding the Ant., R.F. and osc. coils you can have a red hot 10 meter receiver. We have plenty of these in the original factory carton. Priced less the 28 volt dynamotor.
Has 3—12SK7, 12SR7, 12K8, and 12A6.
Near new BC-454-B 3 to 6 MC receiver with all six tubes ....Net **$3.95**
Near new BC-455-B 6 to 6 MC receiver with all six tubes ....Net **$3.95**
Brand new factory cartoned BC-454-B 3 to 6 MC with all tubes **$5.95**
Brand new factory cartoned BC-455-B 6 to 9 MC with all tubes **$5.95**
Receiver dynamotors 28 volts............Net **$0.95**
BC-946-B Broadcast receiver with diagram and tubes. Fact. cartoned..$12.95

Triple remote control head for SCR-274 (BC-453-B, BC-454-B, BC-455-B) **$1.95**
Flexible cable for tuning SCR-274 ....**$0.79**
Mounting Rack for three receivers **$1.95**

AIRCRAFT TRANSMITTERS

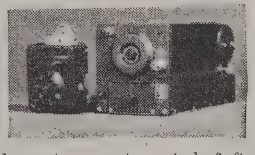
BOTTOM VIEW

This really fits the ham's dream. Ideal for a 55 watt transmitter with 575 volts at 250 MA plate supply, or VFO to drive a high power rig. It's a companion unit to the 454-455-453 series aircraft receivers. Made by Western Electric and really rugged. The oscillator will hold the frequency, even under rough operating conditions. Has 12J5 M. O. and 2—1625 (807) in parallel as final P. A.; or buffer to feed into a high power rig. Built-in crystal dial calibration checker. Antenna loading inductance.
Near new BC-457-A Transmitter 4 to 5.5 MC. Complete with 4600 KC crystal and tubes.
Your Cost **$3 95**
Near new BC-458-A Transmitter 5.3 to 7 MC. Complete with 6200 KC crystal and tubes.
Your Cost **$5.95**

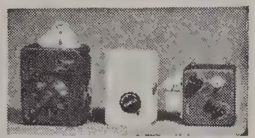
NEW TRANSMITTERS

Scr-274 (AN/ARC-5) SCOOP!
Brand new, factory cartoned transmitters BC-457-A 4 to 5.3 MC with tubes and crystal..........**$9.95**
Brand new, factory cartoned transmitters BC-458-A 5.3 to 7 MC with tubes and crystal..........**$9.95**
Brand new, factory cartoned trans. BC-459-A 7 to 9 MC with tubes and crystal...............**$9.95**

NEW NAVY 6-9 MC. REC., $7.95

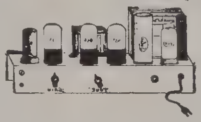


Navy Aircraft Receiver R 27. 6 to 9 MC. Brand new, factory cartoned. Has black wrinkle finish. With tubes 2—12SK7, 12K8, 12SF7, 12SR7 and 12A6. This is the latest model with stabilized oscillator. Priced with tubes, 28 volt dynamotor, remote control, 6 ft control cable. Less the power cable.
Scoop Price **$7.95**



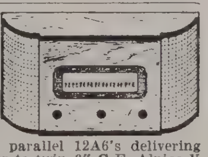
Left to Right

New Remote Control Head and volume control CW, MCW, sw. for BC-455-B 6 to 9 MC receiver.
Scoop Price..**$0 99**
BC-631-13 Jack Box, NEW. Has 10M gain control and Jones 6 screw terminal block. Salvage Price..........**$0.29**
Salvage Scoop BC-732-A Radio Control Box. Toggle switch, volume control and 6 position single pole cam-operated switch; phone jack. Scoop Price. **$0.49**



12 WATT Amplifier Kit, $10.95. For recording and utility use. Matched component parts assure low hum level and good bass. One control, fades from record to microphone; tone control. Priced complete with all parts and tubes: 2—6V6, 6SN7, 6SH7, 7Y4. Diagram and photos furnished. 12" Alnico V PM speaker **$6.95** extra. Crystal desk mike **$4.95** extra.
Kit AC-12. Net.........................**$10.95**

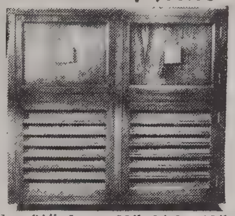
9-TUBE KIT, $24.95



AHK-11 Kit. A deluxe 9 tube, twin speaker, high fidelity receiver kit; housed in a beautiful hand rubbed walnut cabinet; of latest design, with dual speaker grills in perforated gold tint plastic.

Circuit employs push-pull parallel 12A6's delivering 10 watts of undistorted power to twin 6" G.E. Alnico V speakers. Other tubes: 12K8, 12SK7, 12H6, 12J5, 12SL7 and two dry disc rectifiers in voltage doubler circuit (equivalent to 11 tubes in all). Has 10" slide rule dial. Complete with instructions; ready to wire. Your Net **$24.95**

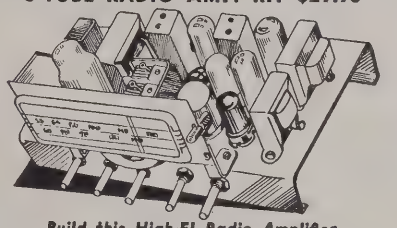
DELUXE CONSOLE CABINET, $39.95



- **Slide Away Changer Comp.**
- **Record Album Compartment**
- **Beautiful, All Walnut Construction**

This is the first time we have been able to offer a beautiful floor model console, RADIO-PHONO cabinet. Finest all walnut construction; hand rubbed finish. 34" long, 33" high, 16" deep. Holds 12" speaker, large record compartment. Slide away changer compartment will accommodate changer of the Webster 56 class and smaller. Receiver compartment is 15x14½x7½ inches. Will accommodate our Model PRK-10 kit; advertised below. Dealers, here is your chance to buy good cabinets at the right price. Convert those low-priced sets into radio-phono combinations. Weight 50 lbs. Net, **$39.95.** Price with Webster 56 changer....**$59.90**

8-TUBE RADIO AMP. KIT $29.95



Build this High-FI Radio Amplifier

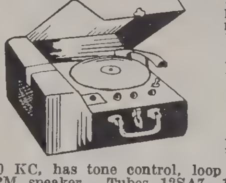
- **Beautiful 8" Slide Rule Dial.**
- **Standard Superhet Circuit covering Broadcast 550 to 1700 K.C.**
- **2-Gang Tuning Condenser.**
- **Offered with 12 or 15 in. PM Speakers. Push-pull 6V6 Output stage giving 15 watts of full range audio.**
- **Dual Tone Controls (Bass and Treble).**
- **Inputs for both Mike and Phono pick-up.**

Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, two 6V6 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 35 lbs. PRK-10 Radio Amp. Kit with 12 P.M. Speaker........Net **$29.95**
PRK-10X Radio Amp. Kit with 15 In. $30.00 value Cinnaudagraph speaker................Net **$42.95**
WHY NOT ORDER A G.I. RECORDER MECHANISM AND THE CABINET, SHOWN ABOVE, WITH THIS KIT? PRICES ON G.I. UNITS ELSEWHERE IN THIS AD.

Walnut mantel type cabinet; made expressly to house the PRK-10 kit. Ready cut. Accommodates receiver chassis only, not speaker. Weight 8 lbs.
Net. **$6.95**

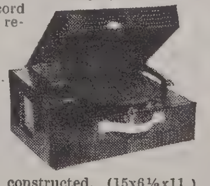
Army BC-221 Frequency Meter in good condition **$39.95**

RADIO-PHONO COMB. KIT, $24.95



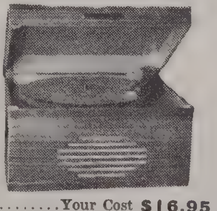
Build this beautiful portable combination radio phonograph. We furnish everything. Beautiful two tone portable case, latest rim drive phono motor, Astatic crystal pick-up. All parts to build high quality 5 tube AC-DC radio. Tunes broadcast 550 to 1650 KC, has tone control, loop antenna, 6" Alnico 5 PM speaker. Tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5. Simple diagram furnished. Kit Model RP-12. Wt. 20 lbs. ....Your Cost **$24.95**

RECORD PLAYER SCOOP, $14.95



Assemble this single record player. Only a few minutes required to mount pick up, motor and ready wired and tested amplifier. Everything furnished including tubes 12SR7, 50L6 and 35Z5. Has heavy duty Alnico V PM speaker, tone and volume controls. Has latest crystal pick up and 78 RPM phono motor. The attractive Alligator covered case is small and ruggedly constructed. (15x6½x11.) This is our leader in a portable record player. Weight 18 lbs. Kit J-20. Net.......................**$14.95**

WALNUT CABINET RECORD PLAYER
$16.95



Beautifully made, highly polished walnut cabinet with hinged lid. Plays 10" records with lid closed. Latest rim drive phono motor and high output. Astatic crystal pick-up. High power 3 tube AC-DC phono amplifier (wired and tested). Heavy duty 4" Alnico 5 PM Speaker. Single record player kit.
Model WL-3. Wt. 15 lbs. ....Your Cost **$16.95**

McGEE RADIO COMPANY ***WRITE FOR CATALOG***

SEND 20% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

"SPECIALS"

ANTENNA RELAY UNIT BC-442

With antenna current meter, antenna transfer relay with 3 stand-off lead-in terminals. A-1 condition. Only........................ **95c**

TRANSFORMER

High voltage scope transformer, 90V 60 cps. primary; 6400 V secondary; 4 stand-off terminals........................each **$2.95**

ANTENNA TRANSFER SWITCH SW-225

Triple-pole, double-throw, mounted on bakelite base with nine 2" porcelain stand-off mounts. BRAND NEW................. **89c**

BC 732 CONTROL BOX

With 6 position, selective switch, volume control and toggle switch...........each **79c**

COAXIAL CABLE

26 ft. of Coaxial Cable RGU8, 52 ohm..... **89c**

OUTPUT TRANSFORMERS

50L6............39c 6V6.............39c

FILTER CHOKES
All Fully Enclosed

Dual, 15H. @ 100 MA., 400 ohms DC. Each section, 500 VDC insulation test. 3½"x3"x6" High; 4 MTG. Studs and 4 terminals. Each **79c**

59H. Min. @ 100 MA.; 10 V RMS 60 cycles, 850 ohms DC. Res.; 4 MTG. Studs, size 4⅝"x 3¹⁵⁄₁₆x3⅝", each........................ **79c**

3.7 H. @ 145 MA. DC., 125 ohms DC. Res. 4 MTG. Studs, each...................... **59c**

I-70-D TUNING METER

Milliammeter for indicating resonance of tuned station, NEW............... **49c** ea.

INSULATOR

2 Ceramic bowls, 3¼" dia............. **29c** ea.

400 CYCLE AUTOSYN MOTOR

Ideal for indicating direction of antenna systems—BRAND NEW............ **95c** ea.

FLEXIBLE CABLE

From 92" to 250" with connectors and spline knobs....................... **$1.95**

HEADPHONES

Signal Corps, 8000 ohms and 200 ohms, each........................... **$2.49**

2000 ohms, Trimm, each................ **1.79**

EARPHONES, less headband, HS18 high impedance......................... **79c**

INTERPHONE AMPLIFIER

Comes in an aluminum cabinet 9¾x4¾x5½" with two 12J5GT and two 12A6 tubes; also Electric Dynamotor 28DC Volt input and 250 V DC output at 60 MA.

Complete with 4 tubes. Yours for only **$4.95**

LP-21 ADF LOOP

Low impedance loop, good for direction finder, one Selsyn motor, one Selsyn transmitter, freq. range of loop 100 Kc to 1750 Kc: BRAND NEW in original cartons; each........... **6.95**

PE-117 UNIVERSAL POWER SUPPLY

6 or 12 volt input; output 145 volts and 90 volts; less vibrator, voltage regulator and rectifier tube; ideal mobile power supply unit; excellent condition, each................ **4.95**

Wholesalers, dealers, Institutions and other quantity purchasers, write, wire, phone for quantity prices. All shipments F.O.B. Chicago. 20% deposit required on all orders. Minimum order accepted $5.00.

WRITE FOR CATALOG

Dept. C

ARROW SALES, INC.
59 WEST HUBBARD STREET
CHICAGO 10, ILLINOIS
Telephone: SUPERIOR 5575

Parts Lists

(FOR CIRCUIT DIAGRAMS APPEARING ON PAGES 76 AND 77)

ADMIRAL MODELS 7T06, 7T12

Part No.	Code and Description.
60B8-153	R_1—15,000 ohm, ½ w. res.
60B2-474	R_2—470,000 ohm, ¼ w. res.
60B8-224	R_3—220,000 ohm, ½ w. res.
60B8-333	R_4—33,000 ohm, ½ w. res.
60B2-475	R_5, R_8—4.7 megohm, ¼ w. res.
60B2-225	R_6—2.2 megohm, ¼ w. res.
75B1-1	R_7—1 megohm vol. control
60B2-105	R_9, R_{10}—1 megohm, ¼ w. res.
60B2-391	R_{11}—390 ohm, ¼ w. res.
61A2-1	R_{12}—.75 ohm, ½ w. res. (wire)
60B2-222	R_{13}—2200 ohm, ¼ w. res.
64B1-25	C_1, C_7, C_{13}, C_{14}, C_{16}, C_{17}—.01 μfd., 400 v. cond.
65B5-31	C_2, C_6—.0008 μfd. mica cond.
66A9-1	C_3, C_4—Ant. & osc. trimmer
65B7-17	C_5—.0001 μfd. mica cond.
64B1-14	C_8—.002 μfd., 600 v. cond.
67A4-2	C_9—4 μfd., 150 v. elec. cond.
64B1-32	C_{10}—.05 μfd., 200 v. cond.
65B7-22	C_{11}, C_{12}—.00025 μfd. mica cond.
64B1-12	C_{15}—.005 μfd., 600 v. cond.
AC105-1	L_1—Antenna coil
A1020	L_2—Osc. coil
72B5	L_3—First i.f. trans.
72B6	L_4—Second i.f. trans.
AB103-1	L_5—R.f. choke coil
98A5	T_1—Output trans.

EMERSON MODELS 507, 509, 518, 522, 535
CHASSIS MODEL 120005

Part No.	Code and Description.
397000	R_1, R_9—15 megohm, ¼ w. res.
321330	R_2—3.3 megohm, ¼ w. res.
390000	R_3—.5 megohm vol. control
321130	R_4, R_5—470,000 ohm, ¼ w. res.
340290	R_6—150 ohm, ½ w. res.
370490	R_7—1000 ohm, 1 w. res.
310810	R_8—22,000 ohm, ¼ w. res.
340010	R_{10}—10 ohm, ½ w. res.
397040	R_{11}—15 ohm, 1 w. wirewound res.
321050	R_{12}—220,000 ohm, ¼ w. res.
900160	C_1, C_2—2-gang var. cond.
	C_3, C_4—Trimmers (Part of var. cond.)
	C_5, C_6, C_7, C_8—Trimmers (Part of i.f. trans.)
920010	C_9, C_{15}—.002 μfd., 600 v. cond.
920249	C_{10}—.0005 μfd., 600 v. cond.
920020	C_{11}, C_{12}—.02 μfd., 400 v. cond.
910000	C_{13}—.00022 μfd. mica cond.
920040	C_{14}—.1 μfd., 200 v. cond.
920030	C_{16}—.05 μfd., 400 v. cond.
925000	C_{17}, C_{18}—30/50 μfd., 150/150 v. elec. cond.
920050	C_{19}—.2 μfd., 200 v. cond.
700000 or 700200	L_1—Loop ant.
720000	T_1—First i.f. trans.
720100	T_2—Second i.f. trans.
734000	T_3—Output trans.
716010	T_4—Osc. coil
	SW_1—Line sw. on vol. control

CROSLEY MODEL 56FC

Part No.	Code and Description.
AC-134898	1A, 1B, 1C—3-section var. cond.
39004-1	2—10 μμfd., 500 v. mica cond.
B-132386-12	3A, 3B, 3C, 3D—4-section trimmer cond.
39001-80	4, 5—.02 μfd., 600 v. cond.
39001-17	6—.05 μfd., 600 v. cond.
39001-76	7, 14, 16—.003 μfd., 600 v. cond.
39001-1	8—100 μμfd., 600 v. cond.
GC-210685-99	9—600 μμfd., 300 v. mica cond.
W-49652-15	10—Trimmer cond.
GC-210685-138	11—480 μμfd., 500 v. mica cond.
W-135130	12—Padder cond.
B-226638-54	13—75 μμfd., 500 v. mica cond.
W-49664	15A, 15B—15/15 μfd., 140/140 v. elec. cond.
39001-78	17—.006 μfd., 600 v. cond.
39001-74	18—.002 μfd., 600 v. cond.
39294-25	19—100,000 ohm, ½ w. res.
39294-23	20—47,000 ohm, ½ w. res.
39294-35	21, 32—4.7 megohm, ½ w. res.
39294-37	22—10 megohm, ½ w. res.
39294-26	23—150,000 ohm, ½ w. res.
39294-31	24—1 megohm, ½ w. res.
39294-33	25—2.2 megohm, ½ w. res.
39294-34	26—3.3 megohm, ½ w. res.
39294-27	27—220,000 ohm, ½ w. res.
39294-6	28—68 ohm, ½ w. res.
39294-17	29—4700 ohm, ½ w. res.
B-130520-3	30A, 30B, 30C—1 megohm vol. control & sw. assembly
39294-16	31—3300 ohm, ½ w. res.
B-135198	32—100,000 ohm tone control
39014-25	33—1000 ohm, ½ w. res.
AW-135133	35—R.f. coil assembly
AW-135147	36—H.f. ant. coil assembly
AW-135134	37—B.c. coil assembly
AW-135140	38—H.f. osc. coil assembly
AW-135141	39—B.c. osc. coil assembly
AW-132803	40—First i.f. trans.
AW-132804	41—Second i.f. trans.

ARVIN MODELS 555, 555A, 552N, 552AN

Part No.	Code and Description.
C20060-103	R_1—10,000 ohm, ¼ w. res.
C20060-106	R_2—10 megohm, ½ w. res.
C20060-223	R_3—22,000 ohm, ¼ w. res.
C20060-331	R_4—330 ohm, ¼ w. res.
C20060-225	R_5—2.2 megohm, ¼ w. res.
C20060-156	R_6—15 megohm, ¼ w. res.
C19389	R_7—Vol. control & sw.
C20060-220	R_8—22 ohm, ¼ w. res.
C20060-474	R_9, R_{10}—.47 megohm, ¼ w. res.
C20060-151	R_{11}—150 ohm, ¼ w. res.
C20060-334	R_{12}—330,000 ohm, ¼ w. res.
C20070-123	R_{13}—12,000 ohm, 1 w. res.
E19359 or C19840	C_1, C_2—2-gang var. cond.
C20068-103	C_3—.01 μfd., 400 v. cond.
C20065-500	C_4—.00005 μfd., 500 v. cond.
A19765	C_5—.2 μfd., 400 v. cond.
C20067-503	C_6—.05 μfd., 200 v. cond.
C20068-503	C_7—.05 μfd., 400 v. cond.
C20068-202	C_8, C_{12}—.002 μfd., 400 v. cond.
C20065-251	C_9—.00025 μfd., 500 v. cond.
C20065-501	C_{10}—.0005 μfd., 500 v. cond.
A19360	C_{11A}, C_{11B}—40/20 μfd., 150/150 v. elec. cond.
C20068-203	C_{13}—.02 μfd., 400 v. cond.
AC19207-1	L_1—Ant. loop assembly
AC19354-1	L_2—Osc. coil
AC19357-1	L_3—Iron core "B" choke
AC19355-1	T_1—First i.f. coil
AC19356-1	T_2—Second i.f. coil
AC19358-1	T_3—Output trans.

GAROD MODEL 5A1

Part No.	Code and Description.
1.443	1—Loop assembly
2.200	2—2-gang var. cond.
1.259	3—First i.f. trans.
1.259	4—Second i.f. trans.
8.200-9 or 8.200-4	5—Vol. control & sw.
30.303	6—4" PM speaker & output trans.
5.415-2	7—20/20/20 μfd. elec. cond.
1.444-1	8—Osc. coil

For other values see circuit diagram

BELMONT MODEL 5P19

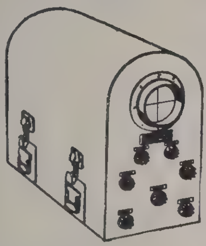
Part No.	Code and Description.
C-9B1-27	R_1—220,000 ohm, ½ w. res.
C-9B1-67	R_2—2700 ohm, ½ w. res.
C-9B1-84	R_3—68,000 ohm, ½ w. res.
C-9B1-302	R_4—15 megohm, ½ w. res.
C-9B1-62	R_5—1000 ohm, ½ w. res.
C-9B1-34	R_6, R_{10}—3.3 megohm, ½ w. res.
101252	R_7, S_2—1 megohm vol. control & sw.
C-9B1-37	R_8—10 megohm, ½ w. res.
C-9B1-31	R_9—1 megohm, ½ w. res.
C-9B1-42	R_{11}—22 ohm, ½ w. res.
130343	R_{12}—545 ohm, 14 w. res.
C-9B1-66	R_{13}—2200 ohm, ½ w. res.
130344	R_{14}—1975 ohm, 6 w. res.
1009	C_1—.05 μfd., 200 v. cond.
B-8A-10246	C_{2A}, C_{2B}, C_3, C_4—Two-gang cond. including ant. & osc. trimmers. Range of gang 14-452 μμfd. (ant.) and 10-198 μμfd. (osc.)
1295	C_5, C_{12}—100 μμfd. mica cond.
100128	C_6—.05 μfd., 120 v. cord.
100135	C_7—.25 μfd., 120 v. cond.
100127	C_8, C_{13}—.01 μfd., 120 v. cond.
	C_9—Part of i.f. (approx. 100 μμfd.)
100134	C_{10}—.006 μfd., 120 v. cond.
100133	C_{11}—.1 μfd., 120 v. cond.
10025	C_{14}—.002 μfd., 600 v. cond.
10013	C_{15}—.05 μfd., 400 v. cond.
119123	C_{16A}, C_{16B}, C_{16C}, C_{16D}—20 μfd./40 μfd./200 μμfd./40 μfd., 50/150/10/150 v. elec. cond.
B-13E-10250	T_1—Loop antenna assembly
A-13D-10239	T_2—Osc. coil
108201	T_3—Input i.f. trans. Range of trimmers 53-97 μμfd. each
108200	T_4, C_9—Output i.f. trans. Range of trimmers 39-71 μμfd. each
105127	T_5—Output trans.
125153	S_1—Line-battery sw.

—30—

In the Circuit Page of July, 1947, page 71, the circuit diagrams for the Coronet Model C-2 and the Crosley Models 56PA, 56PB were inadvertently switched. Please make this correction.

SPECIALS from "ARROW"

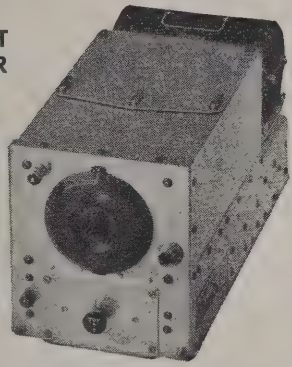
BC-612



Modified BC-412, 5″ Radar Oscilloscope; ideal for first class laboratory instruments; 110V 60 cycles, complete with tubes and power supply brand new in original cartons.

Each... **$49.95**

ARMY AIRCRAFT RECEIVER Model BC-946-B



Broadcast band from 520 to 1500 kc. Tube complement: 3—12SK7, 1—12SR7, 1—12A6, 1—12K8. Designed for dynamotor operation, but is easily converted to 110 or 32 volt operation. Has two I.F. stages and three gang condenser. Comes packed in sealed carton complete with tubes and instruction manual, but less dynamotor.................**$12.95**

RADIO RECEIVERS

BC-454-A; 3-6 mc complete with tubes...**$3.95**

BC-453-A; 190-550 kc complete with tubes **$4.95**

BC-455-A; 6-9 mc complete with tubes....**$3.95**

All above used, in A-1 condition.

Brand new in original cartons........... **5.95**

ARA NAVY RECEIVER

1.5 to 3 Meg...........................**$4.95**

Used, in A-1 condition. Complete with 6 tubes

DYNAMOTOR

DM 32A. Each **95c,** 3 for..................**$2.00**

MODULATOR UNIT

BC-456-A..............................**$2.95**

REMOTE CONTROL BOX

BC-450-A... ....**$1.95**

ARB AIRCRAFT RADIO RECEIVER

The ARB is a six tube, four band, superheterodyne Aircraft Radio Receiver with built-in dynamotor, designed for the reception of MCW (tone or voice) or CW within the frequency range 195 Kc to 9.05 megacycles.

Used..............................**$16.95**

AN18/APT-10

Pre-amplifier model K-1, designed to raise output level of magnetic type microphone, complete with 2 tubes 6SL7GT and 28D7 and hand switch, brand new in original cartons.

Each **$1.95** 3 for **$5.00**

ART-13 TRANSMITTER

Used, in good condition, complete with tubes and calibrating crystal, freq. range 2,000 Kc to 18 mc; A-1, A-2, A-3 type transmission; power output 100 watts..............Each **$75.00**

RAX-1 3-RECEIVER COMBINATION

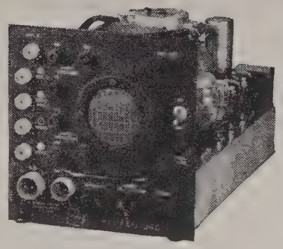
No. 1—4 bands, tunes from 200-1500 kc. ea. **$15.00**

No. 2—4 bands, tunes from 1500 kc to 9 mc. ea. **15.00**

No. 3—5 bands, tunes from 7 to 27 mc...ea. **19.95**

Each receiver complete with tubes and 24 V Dynamotor. Used, A-1 condition. 3 Receiver combination................complete **$34.95**

BC-929-A



Contains power supply 110 V, 400 cycles, has 7 tubes such as 3CP1, brand new, complete with tubes.

Each....**$17.95**

Used, ea. **14.95**

APS-15

Has 45 tubes, one 5″ scope tube, one 2″ scope tube, has 3 meters, 4 power supply units 110V 400 cycles, complete with tubes. Each............... **$39^50**

BC-348 RECEIVER P or Q

Brand New in original cartons..........**$49.95**

VHF RECEIVER BC-701

Frequency range 170-180 Mc; IF 30.5 Mc; complete with 11 tubes; self-contained power supply, brand new in beautiful wooden carrying case................................**$9.95**

BC-404-C VHF RECEIVER

Frequency range 102-110 Mc; complete with 12 tubes, 110V 60 cps, power supply included.

Brand new in original cases............**$19.95**

used **$14.95**

NAVY GLIDE PATH RECEIVER

Bolt type, complete with 3 6C6 tubes and tunes from 90 to 95 Mc, operates from 12 or 24V.....................Brand new **$2.95**

RANGER MODEL 114-C AIRCRAFT RECEIVER

Combination Interphone, Amplifier and 6-Tube Superheterodyne Receiver designed to operate directly from a 24V aircraft battery. Tuning range 200 kc to 550 kc. complete with mounting rack, jackbox and cords. This unit is used as range receiver and interphone amplifier.

Brand new...........................**$14.95**

GF12 and RU 17 NAVY RECEIVER and TRANSMITTER

Complete with receiving and transmitting coils, junction box, control boxes, plugs, power supply, instruction manual and spare parts which include tubes. Brand new in original carton.

A real buy.................. ....**$24.95**

GO-9

Navy type low and high frequency transmitter with power supply and tubes. Operates from 200 Kc to 18,100 Kc; requires 115V, 800 cycles,

Used. complete with tubes.............**$39.50**

HAND-TYPE MICROPHONE RS-38

Carbon type, with PL-68 plug, brand new...**$1.95**

Used.. **1.00**

MICROPHONE AND RECEIVER P-60

Dynamic type, 50-ohm impedance; mike and phones interminate in 5-wire male plugs, 3-ft. cord..............................**$1.49**

OXYGEN MASK MICROPHONE T44C

Used with SCR-522, magnetic type complete with JK-26 and PL-179. NEW...Ea. **$1.29**

Wholesalers, dealers, institutions and other quantity purchasers . . . Write, Wire, Phone for Quantity Prices. All Shipments F.O.B. Chicago—20% Deposit Required on all orders. Minimum order accepted $5.00.

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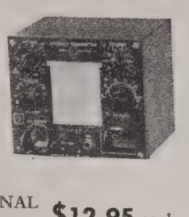
SCOOP of the Month!

RCA AVT-112A
Aircraft Transmitter



For radio-telephone communication; for 6, 12 or 24 volt source; band of from 2,500 to 6,500 Kc. Small in size and wt. (wt. 6 lbs.). Complete with 6 tubes, oscillator circuit, power amplifier modulators, dual tuning indicator and amplifier, with instrucstion manual, less crystal . .

BRAND NEW IN ORIGINAL CARTONS—ONLY...............**$12.95** each

APN-9 RADIO RECEIVER INDICATOR UNIT

Complete with SELF-CONTAINED POWER SUPPLY; 29 tubes and 3″ scope tube; 110 V. 400 cycles; used, but in excellent condition-dition..............................**$29.95**

Power Supply for the APN-4; complete with 16 tubes; 110 V. 400 cycles........**$14.95**

RADIO TRANSMITTER MODEL BC-458

Tunes from 5.3 to 7 mc, complete with tubes and crystal. Brand new in original cartons........................... **$5.95**

SETCHELL CARLSON RADIO RECEIVER

BC-1206-C

Designed to receive A-N beam signals. 24-28 vdc 21.6 watts. Tube complement: 14H7 or 14A7, RF amplifier; 14H7 or 14J7, mixer; 14A7 or 14H7, IF amplifier; 14R7, detector and 1st audio amplifier; 28D7, output amplifier. 195 to 420 kc. 4″ high x 4″ wide x 6⅝″ long—wt. 3 lbs., 4 oz.

Used A-1 cond..........................**$4.95**

BRAND NEW

in original carton....................... **7.95**

RADIO TRANSMITTER and RECEIVER APS-13

Light weight air-borne radar system, radio transmitter and receiver APS-13; tube complement: 5—6J6, 9—6AG5, 1—VR105, 2—D21; unit is brand new, complete with tubes, the tubes alone are worth more than this LOW PRICE OF ONLY..................................**$15.00**

GLIDE PATH RECEIVER R-89/ARN-5

Glide Path Receiver used in the Instrument Landing System covering the frequency range 332 to 335 mc; complete with the following tubes: 7—6AJ5, 1—12SR7, 2—12SN7, 1—28D7, and including three crystals 6497KC, 6522KC, 6547KC . . . units are in A-1 condition for ONLY..............................**$9.95**

SCR-522 TRANSMITTER and RECEIVER

The standard very-high frequency airborne receiver transmitter. 100 to 156 megacycles. 4 channels selected from remote control box. Used, in good condition—"Complete with Tubes" ONLY.................................**$19.95**

BC-625

VHF transmitter, frequency range 100-156 Mc; four channels. Part of the SCR-522. Complete with tubes less crystals.

Used, good condition..............ea. **$10.95**

BC-624

VHF Companion receiver for above transmitter. Complete with tubes less crystals. Used, good condition. Diagram with either unit included ....ea. **$9.95**

VEEDER-ROOT METER AND CASE

Counts up to 1000.

Each..................................**95c**

WESTON OUTPUT METER No. 687

3 scales 0-50.

A-1 Condition....................ONLY **$6.95**

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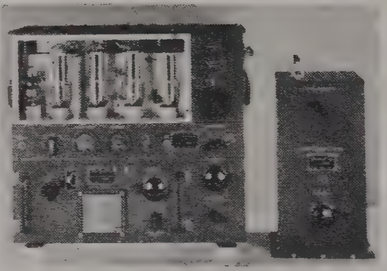
RADIOMEN'S HEADQUARTERS ** WORLD WIDE MAIL ORDER SERVICE!!!

BC-947A ONE KILOWATT HIGH FREQUENCY TRANSMITTER

This relay-controlled transmitter includes a 115V, 60 cycle power supply, protected by 3 magnetic circuit breakers, that alone is worth more than the price we are asking for the whole rig, even on today's surplus market. On the front panel are six 3½" GE or Weston meters, including 250 MA, 50 MA, 1000 MA, 150V AC, and 1500V DC at 1000 ohms per volt for screens and plate. The rack-type 21"x15"x36" unit contains six amplifier and rectifier tubes aggregrating over $60.00 at WAA current wholesale prices. Western Electric's price to the government was $1500.00. Shipping weight 500 lbs. Your cost, as is, only $69.95.

ARMY BC 312 COMMUNICATIONS RECEIVER

This receiver covers the frequency range of 1.5 MC to 18 MC in six direct reading bands. The dial, that is driven with split gears to prevent backlash, has 4500 logging divisions per band with approximately 600 divisions on the 20 and 40 meter ham bands and 1000 divisions on 80 meters. Two stages of RF before the converter in this set give it a very high signal to noise ratio and maximum sensitivity. Outstanding features of this receiver are: BFO with pitch control, send-receiver relay, jacks on the front panel for headphones and speaker output and mike and key input, all tubes are standard 6 volt types. This receiver was designed to withstand rough usage in the field and for operation from vehicles while in motion, so it is ruggedly constructed and contains a dynamotor power supply.—Your cost $49.95. Conversion kit to 110 VAC is available for $6.50.



GENERAL ELECTRIC 150-WATT TRANSMITTER

Cost the Government $1800.00
Cost to you $44.50!!!

This is the famous transmitter used in U. S Army bombers and ground stations, during the war. Its design and construction have been proved in service, under all kinds of conditions, all over the world. The entire frequency range is covered by means of plug-in tuning units which are included. Each tuning unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliameter, voltmeter, and RF ammeter are mounted on the front panel. Here are the specifications: FREQUENCY RANGE: 200 to 500 KC and 1500 to 12,500 KC. (Will operate on 10 and 20 meter band with slight modification.) OSCILLATOR: Self-excited, thermo compensated, and hand calibrated. POWER AMPLIFIER: Neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. MODULATOR: Class "B"—uses two 211 tubes. POWER SUPPLY: Supplied complete with dynamotor which furnishes 1000V at 350 MA. Complete instructions are furnished to operate set from 110V AC. SIZE: 21½ x 23 x 9¼ inches. Total shipping weight 200 lbs., complete with all tubes, dynamotor power supply, five tuning units, antenna tuning unit and the essential plugs. These units have been removed from unused aircraft and are guaranteed to be in perfect condition.

GENERAL ELECTRIC RT-1248 15-TUBE TRANSMITTER-RECEIVER

TERRIFIC POWER—(20 watts) on any two instantly selected, easily pre-adjusted frequencies from 435 to 500 Mc. Transmitter uses 5 tubes including a Western Electric 316 A as final. Receiver uses 10 tubes including 955's, as first detector and oscillator, and 3 7H7's as IF's, with 4 slug-tuned 40 Mc. IF transformers, plus a 7H7, 7E6's and 7F7's. In addition unit contains 8 relays designed to operate any sort of external equipment when actuated by a received signal from a similar set elsewhere. Originally designed for 12 volt operation, power supply is not included, as it is a cinch for any amateur to connect this unit for 110V AC, using any supply capable of 400V DC at 135 MA. The ideal unit for use in mobile or stationary service in the Citizen's Radio Telephone Band where no license is necessary. Instructions and diagrams supplied for running the RT-1248 transmitter on either code or voice, in AM or FM transmission or reception, for use as a mobile public address system, as an 80 to 110 Mc. FM broadcast receiver, as a Facsimile transmitter or receiver, as an amateur television transmitter or receiver, for remote control relay hook-ups, for Geiger-Mueller counter applications. It sells for only $29.95 or two for $53.90. If desired for marine or mobile use, the dynamotor which will work on either 12 or 24V DC and supply all power for the set, is only **$15.00** additional.

BRAND NEW BC 348 COMMUNICATIONS RECEIVER

Featuring coverage from 200 to 500 Kc. and 1500 to 18000 Kc. on a direct reading dial with the finest vernier drive to be found on any radio at any price—high sensitivity with a high degree of stability—crystal filter—BFO with pitch control—standard 6 volt tubes. Contains a plate supply dynamotor in a compartment within the black crackle finished cabinet, the removal of the dynamotor leaves plenty of room for the installation of a 110V, 25 or 60 cycle power supply. These receivers, which make any civilian communications receiver priced under $200.00 look cheap and shabby by comparison, are only **$69.95** brand **new. Power supply kit for conversion to 110V 25 or 60 cycles is only $8.50** additional.

RT1463 7 tube amplifiers containing 3-7F7, 1-7Y4, 3-7N7, 4 potentiometers, numerous resistors, filter and bypass condensers, filter chokes, power and audio transformers, and six sensitive plate circuit relays. A military development that provided amazing stepless control proportional to correction required, for ailerons, rudder and elevator, in the original application. A control amplifier of the ordinary type would deflect the rudder by some arbitrary amount when the ship was blown off the course to port or starboard. The result would either be that the correction was insufficient and the plane continued off course, or the correction would be too great, starting a series of tackings that would greatly increase fuel consumption and elapsed time in reaching the objective. This phenomenal unit, with its 3 amplifiers and six 5000 ohm relays in bridge circuits, will accurately control any 3 operations, related or unrelated, in minutely adjustable uniquely quantitative variations in either forward or reverse directions. 9"x7"x8" black crackle aluminum case. Brand new in original carton **$12.95**, or used **$9.95.**

SERVICEMEN

Check This Column for Lowest Prices on Quality Parts

TUBES; all types in stock, 60% off on all tubes if ordered in lots of 10 or more.

POWER TRANSFORMERS — Half-shell type, 110V 60 cy. Centertapped HV winding. Specify either 2.5 or 6.3 filament when ordering.

For 4-5 tube sets—650V, 40MA, 5V & 2.5 or 6.3V	$1.49
For 5-6 tube sets—650V, 45MA, 5V & 2.5 or 6.3V	1.75
For 6-7 tube sets—675V, 50MA, 5V & 2.5 or 6.3V	1.90
For 7-8 tube sets—700V, 70MA, 5V & 6.3 or two 2.5	2.35
For 8-9 tube sets—700V-90MA; 5V-3A; 2.5V-3.5A; 2.5-10.5A	2.85
For 9-11 tube sets—700V, 100MA, 5V & 6.3 or 6.3V-4A	2.85
For 9-15 tube sets: 600V, 150MA; 5V & 6.3V	2.95

TRANSFORMERS — All types in stock. **AUTO-TRANSFORMERS;** Steps up 110v to 220v, or steps down 220v to 110v—**$1.95. FIL. TRANS.:** 6.3v, 8 Amps.—**$1.98**; 5v, 10 Amps.—**$1.98**; Universal Output Trans. 8 Watt—**89c**; 18 Watt—**$1.29**; 30 Watt—**$1.69. AUDIO TRANSFORMERS:** S. Plate to S. Grid 3:1—**79c**; S. Plate to P.P. Grids—**79c**; Heavy Duty Class AB or B, P.P. inputs—**$1.49**; Midget Output for AC-DC sets—**69c**; **MIKE TRANSFORMER** for T-17 Shure microphone, similar to UTC ouncer type—**$2.00.**
Stancor SB or DB mike to line or grid—$1.95.

CONDENSERS—PAPER TUBULAR 600 WV—.001; .002; .005—**8c**; .01; .05—**9c**; .1—**10c**; .25—**23c**; .5—**36c**; **ELECTROLYTICS:** 8mfd 200v—**20c**; 10mfd 35v—**20c**; 30mfd 150v—**23c**; 20/20mfd 150—**35c**; 30/20 150v—**46c**; 50mfd 150v—**43c**; 8mfd 475v—**34c**; 16mfd 350v—**65c**; **OIL CONDENSERS:** 4mfd 600v—**49c**; **BATH TUB TYPE CONDENSERS:** 3X.1mfd—**20c. RESISTORS:** All types in stock at the lowest prices; Resistor Kits—100 2 watt resistors—**$1.95.**

FILTER CHOKES: 200, 300, 400, 500 ohm light duty—**59c**; 200 or 300 ohm heavy duty—**99c**; 250 ma 35 ohm, made for U.S. Navy, fully shielded—**$1.95**; 75 ohm 125 ma—**25c** or 25 for **$4.25**; "Meissner type" tapped filter chokes—**25c**; 8 amp. iron core A filter—**25c**; Choke-condenser combination, ideal to replace any size speaker field when installing PM speakers—**79c.**

110 V. CIRCUIT BREAKERS of Magnetic type: Following Current Ratings in Stock: 1.25, 3, 4, 8 Amps. Please Specify. **$1.95** each.

Seven Assorted I.F. Transformers—**$1.98**; Five Asstd. Oscillator Coils—**69c.**

SPEAKERS-PM dynamic type-4"—$1.55; 5"—$1.55; 6"—$1.95; 8"—**$3.95**; 10"—**$5.95**; 12"—**$7.50.**

HEADPHONES—Highest quality Signal Corps headsets with 12" cord and plug **$1.25.** 5' rubber covered patchcords with phone plug & socket—**45c.**

SELENIUM RECTIFIERS—Dry disc type 1½" by 1": 1.2 Amp. maximum, suitable for converting DC relays to AC, for supplying filament source in portable radios, converting DC meters to AC applications, and also may be used in low current chargers—**90c.**

METER RECTIFIERS—Full wave, may be used for replacement, or in construction of all types of test equipment—**$1.25.** Half Wave—**90c.**

LINE FILTERS—110V—each unit contains two 2 mfd. oil filled condensers and a 15 amp. iron core choke. This filter has innumerable uses such as oil burner line filter, etc. A ten dollar value for **98c.**

WILLARD rechargeable 2v storage batteries for portable radios or any other purpose—**$2.95.**

PUBLIC ADDRESS AMPLIFIERS—25 watts peak output. This unit has separate input circuits for microphone and phono. The gain of the microphone circuit is 122 db. The phono circuit has a gain of 82 db. The frequency response is flat from 50 to 12000 cycles. A $65 value for only **$32.**

Miniature pliers set contains one of each of the following: Needle nose, flat nose, parrot nose, standard nose. All contained in a leatherette case. Your cost—**$1.98.**

ATR battery eliminator. Handy for servicing car radios or any other purpose requiring 6 or 12v at 14 amps. Net price—**$36.00.**

SOCKET WRENCH SET consisting of 5 sockets ranging in size from 5/16 to ½" and a handle—**79c.**

AUTOMATIC WIRE STRIPPERS will strip up to 1000 wires per hour, a handy tool for any service job—**$3.52.**

Six Foot Asbestos Insulated Flat Iron Cords, one end has a male plug, the other end has a standard flat iron socket. Your price—**70c** each or 10 for **$5.**

FREE!!!! THIS MONTH ONLY.
A HIGH GRADE CRYSTAL PICK-UP WITH THE PURCHASE OF EACH PHONO MOTOR AT $4.95.

MICROPHONES — All nationally known brands. Bullet crystal—**$5.45**; Bullet Dynamic—**$7.45**; Mike Jr.—**60c**; Handy Mike—**90c**; Lapel Mike—**93c**; **SHURE T-17 MIKES**, with push to talk switch—**99c.**

20 ASST'D COIL FORMS, including 11 ceramic, 3 polystyrene, and 6 fiber, all useful sizes—**50c.**

VARIABLE CONDENSERS: 350 MMFD, 5 gang—**$1.95**; 4 gang—**$1.49**; 3 gang—**83c**; 2 gang—**79c**; 7.5 to 20 MMFD, 1750v spacing, extra long shaft Hammarlund—**69c**; miniature variables—25 MMFD—**39c**; 50 MMFD—**49c**; 75 MMFD—**59c**; 100 MMFD—**69c**; 140 MMFD—**79c.**

TRANSMITTING RF CHOKES, 4 PIE. 350 Ma.—**25c** or 5 for **$1.00.**

INTERRUPTION FREQUENCY COILS for super-regenerative receivers or the tremendously popular FM adapters for standard broadcast sets. Iron core with a resonant frequency of 50 KC—**39c**; Air Core, 100 KC—**29c.**

30 MC IF TRANSFORMERS, double slug tuned—**25c.**

VIDEO AMPLIFIER PLATE COILS—Slug Tuned—**25c.**

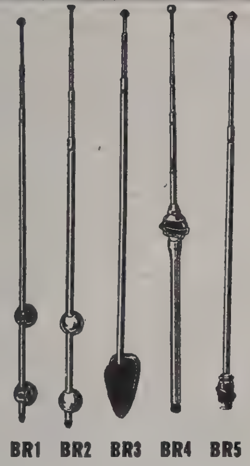
REMOTE CONTROL UNIT: Aluminum case 4x3x2" containing 2 potentiometers, triple pole switch, 4 knobs, gear mechanism, counter and phone jacks—**59c.**

MODULATION TRANSFORMERS: 30 watt, open type—**$1.95**; 40 watt, cast aluminum case—**$2.95**; Class "B" input transformers, cast aluminum case—**$1.95**; Transceiver audio transformers—**65c**; Transceiver modulation transformers—**65c.**

Minimum order $3.00—All prices subject to change.—25% deposit with C.O.D. orders

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 9N, BUFFALO 3, N. Y.
CABLE ADDRESS BUFRAD

RADIOMEN'S HEADQUARTERS ✱✱ WORLD WIDE MAIL ORDER SERVICE!!!



INTRODUCTORY OFFERING OF OUR OWN BRAND CAR RADIO ANTENNAS

All of our car radio antennas are made of triple plated Admiralty Brass Tubing, complete with low loss shielded antenna leads and have high quality fittings.

SIDE COWL—BR-1, 3 sections extend to 66″. Your price—single units—**$1.50;** in lots of 12—**$1.35** ea.

SKYSCRAPER—BR-2 has 4 heavy duty sections that extend to 98″. Your price—single units—**$2.45;** in lots of 12—**$2.25** ea.

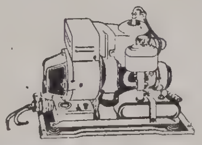
TILT ANGLE—BR-3, may be adjusted to all body contours. 3 sections extend to 66″. Single unit price—**$1.50;** 12 lot price—**$1.25** ea.

VERSATILE—BR-4, single hole fender or top cowl mounting may be adjusted to conform with all body contours. 4 sections extend to 56″. Single unit price—**$2.90;** 12 lot price—**$2.75** ea.

THE MONARCH—BR-5, single hole top cowl mounting, 3 sections extend to 56″. Single unit price—**$1.90;** 12 lot price—**$1.75** ea.

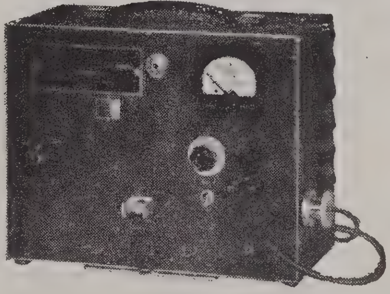
BENDIX SCR 522—Very High Frequency Voice Transmitter-Receiver—100 to 156 MC. This job was good enough for the Joint Command to make it standard equipment in everything that flew, even though each set cost the Gov't. $2500.00. Crystal Controlled and Amplitude Modulated—HIGH TRANSMITTER OUTPIT and 3 Microvolt Receiver Sensitivity gave good communication up to 180 miles at high altitude. Receiver has ten tubes and transmitter has seven tubes, including two 832's. Furnished complete with 17 tubes, remote control unit, 4 crysals, 24 volt dynamotor and the special, wide band VHF antenna that was designed for this set. These sets have been removed from unused aircraft and are guaranteed to be in perfect condition. We include free parts and diagrams for the conversion to continuously variable frequency coverage in the receiver. The cost of this unit is only **$37.95.** Brand new 12 volt dynamotor for SCR 522—**$12.00,** 24 volt dynamotor—**$6.00.** Used SCR 522, less dynamotor, remote control unit and antenna—as-is—**$19.95.**

PE-109 32-VOLT DIRECT CURRENT POWER PLANT



This power plant consists of a gasoline engine that is direct coupled to a 2000 watt 32 volt DC generator. This unit is ideal for use in locations that are not serviced by commercial power or to run many of the surplus items that require 28-32 V. D.C. for operation. The price of this power plant is only $100. We can also supply a converter that will supply 110v AC from the above unit or from any 28-32v DC source for $29.95.

AT LAST YOU CAN AFFORD A LABORATORY STANDARD SIGNAL GENERATOR



Model 78-B Standard Signal Generator. Two Frequency Bands between 15 and 250 megacycles.

The famous Measurements Corp. Model 78B, 5 Tube Laboratory Standard Signal Generator (currently selling new, FOB Boonton, N. J., for $310.00 net), is available in perfect condition for 25 to 60 cycle, 115 V AC operation. Until now this is the sort of top-flight lab equipment that discriminating buyers have only vainly hoped would be released at a bargain price. Worth every cent the manufacturer asks, but available FOB Buffalo while our limited supply lasts for only **$79.95.**

"REMEMBER THAT A STANDARD IS ONLY AS RELIABLE AS ITS MAKER."

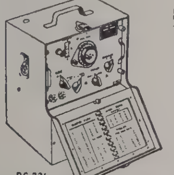
LORAN INDICATOR OSCILLOSCOPE, complete with 26 tubes and a 5″ cathode ray tube, government instruction manual included—**$39.95.**

5″ SO RADAR PPI OSCILLOSCOPE, complete with 9 tubes. This unit contains magnetic deflection yokes and a Selsyn motor—**$39.95. SO RADAR ECHO BOXES, THE PERFECT CALIBRATED CAVITY WAVEMETER—$10.00.**

5″ SO RADAR PPI OSCILLOSCOPE, complete with 9 tubes. This unit contains magnetic deflection yokes and a Selsyn motor—**$39.95. SO RADAR ECHO BOXES, THE PERFECT CALIBRATED CAVITY WAVEMETER—$10.00.**

Range Unit RT-1579 consists of a three stage high gain, high fidelity amplifier and a Helmholtz coil for manually introducing phase shift from 0° to 360°. The amplifier is cascade 6SJ7s driving a 6F6 in the output, also on the same chassis is the 110v 60 cycle power supply. The Helmholtz coil is rotated by a vernier drive mechanism which has a dial that contains 4000 ¼ inch divisions. Your cost—**$14.95.**

RAYTHEON VOLTAGE REGULATOR, will maintain a constant 115 V AC at the load even though the input voltage varies from 95 to 130 volts. The regulation is ½ of 1% with a 75 watt load. Shipping weight 20 pounds. Your cost **$8.95.**

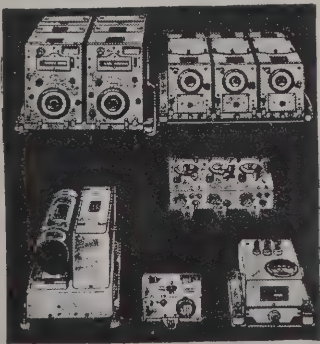


BC 221

SCR-610 TRANSMITTER-RECEIVER ready to operat e on 10 meter phone by connecting it to 6, 12 or 24 VDC—**$49.95.**

Relay Box BC-616 contains 3 high speed DPDT DC relays, that may be used as keying relays, resistors and a 150 MFD condenser. The aluminum box, with cover, measures 5½x6½x2 inches. While this terrific bargain lasts—**$1.95**

BC 221 FREQUENCY METERS with calibrating Crystal and calibration charts. A precision frequency standard that is useful for innumerable applications for laboratory technician service man, amateur, and experimenter, at the give-away price of only **$39.95.**



SCR-274N COMMAND SET

The greatest radio equipment value in history.

A mountain of valuable equipment that includes 3 receivers covering 190 to 550 KC; 3 to 6 MC; and 6 to 9.1 MC. These receivers use plug-in coils, and consequently can be changed to any frequencies desired without conversion. Also included are two Tuning Control Boxes; 1 Antenna Coupling Box; four 28 V. Dynamotors (easily converted to 110 V. operation); two 40-Watt Transmitters including crystals covering 3 to 4 MC and 4 to 5.3 MC; and Preamplifier and Modulator. 29 tubes supplied in all. Only a limited quantity available, so get your order in fast. Removed from unused aircraft and in guaranteed electrical condition. A super value at $29.95, including crank type tuning knobs for receivers.

Minimum order $3.00 - - - All prices subject to change - - - 25% deposit with C.O.D. orders

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 9N, BUFFALO 3, N. Y.
CABLE ADDRESS BUFRAD

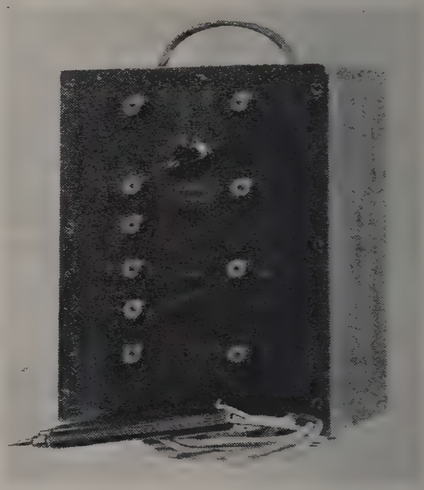
Simple TROUBLESHOOTING AID

A useful test instrument—it combines several practical servicing kinks into a single unit.

By SALVATORE J. MONDELLO

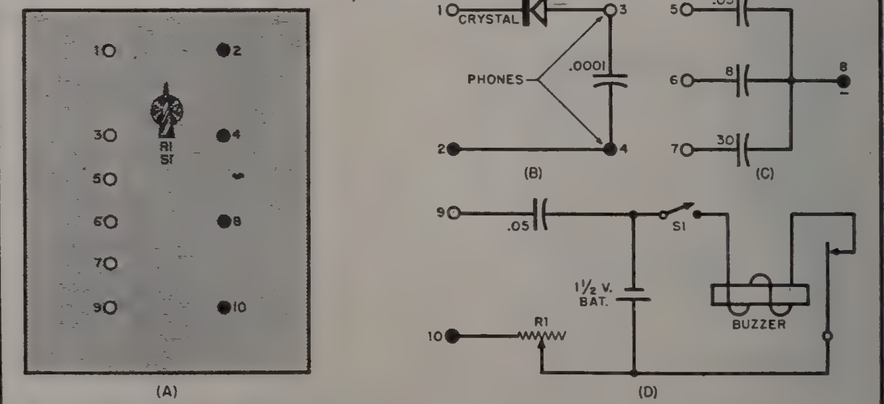
A SIMPLE device which can be built quickly and inexpensively has proved to be a very useful and rugged test instrument in the radio repair shop. The idea is to combine various favorite and practical radio servicing kinks into one unit. Then by inserting test leads into the proper pin jacks, by trying the test prods across the various units in the receiver, a very convenient method for substituting parts by "cut and try" can be achieved.

The 8 μfd. and 30 μfd., 350 volt electrolytic condensers can be used to bridge open or leaky filter condensers in power supplies or power tube bypass electrolytics. Symptoms of such conditions include: bad hum, distortion, motorboating and low audio gain. If the receiver appears normal after this test you have located the defective condenser which should then be replaced by one of the correct value. In this manner the trouble can be located quickly and without annoying shocks to the serviceman or an accidental short across the rectifier plates which so often occurs when handling a large electrolytic while trying to get the leads across the defective one. The .05 μfd. tubular can be used conveniently to bridge any suspected tubular of the approximate value in the set. In substituting a coupling condenser, unsolder one end of the condenser in the set, insert leads in the jacks connected to the .05 μfd. tubular, and bridge the ends of the test leads from the plate of the detector to the grid of the power tube. With the test leads it is easy to "dig in" under a closely crowded spot without causing an accidental short. The 100 μμfd. mica condenser, although part of the crystal detector circuit, may be used across a suspected mica. This is particularly applicable to shorting or periodic oscillator grid leaks and in r.f. filters. For these tests it is best to prepare test leads with a clip on one end so that the prod may be held in



Over-all view of completed instrument.

Diagram shows panel layout and circuits that are incorporated in this unit.



R₁—100,000 ohm pot. (with sw., S₁)
1—Standard type buzzer
2—.05 μfd., 400 v. cond.
1—8 μfd., 350 v. elec. cond.
1—30 μfd., 350 v. elec. cond.
1—100 μμfd. mica cond.
1—1½ v. "C" battery
1—Crystal

The BEST in SURPLUS

Collins AN/ART 13 Autotune 100 watt Transmitters. Brand new in original crates $99.50

BC 222 Walkie Talkies. Cover 28-52 Mc. Crystal calibrator, range 15 miles. Brand new. The ideal amateur portable unit $49.50

BC 457A Transmitters Western Electric 4-5.5 Mc. Brand new in sealed cartons with tubes $4.95

Mine Detectors SCR 625 in excellent used condition $19.50

BC 729C Antenna Tuning units from BC 610. Matches 500 watt transmitter to antenna made by Hallicrafters. Has 0-15 RF Ammeter. Brand new $14.95

BC 306A Antenna Tuning Units. Mfg. by General Electric. Matches 150 watt transmitter to antenna. Brand new $3.95

35' Mast Antenna, Steel, Sectional, with Guys, Base, 50' Coax Lead In, canvas case $29.50

Weston Model 155 Precision AC Voltmeter 0-30 volts, wood case, new $29.50

Weston Model 264 Precision Milliammeter 150-0-150 MA D.C. Bakelite case, new $19.50

Model 62 Measurements Corp. Precision Vacuum Tube Voltmeter used but like new $39.50

Westinghouse Type PX-14 Precision Milliammeter 50-0-50 MA DC. New sealed cartons $14.95

U.H.F. Loctal Sockets, Mica filled cinch .... 10 for $1.00

Thermocouple for R. F. Ammeters. Brand new .... 3 for $1.00

Kit of screw driver type Potentiometers .... 10 for $1.00

Kit of Metal Tubular Bypass Condensers .... 20 for $1.00

Kit of Bathtub Bypass Condensers .... 20 for $1.00

Technical Manual on BC312 and BC342 Receivers, instructions and circuit diagrams, etc. $0.50

Potentiometers Any 12 for $2.50

Mallory 600 ohm 4 watt W.W. 1" Shaft
Mallory 1000 ohm 4 watt W.W. ½" Shaft
Mallory 5000 ohm 4 watt W.W. ¾" Shaft
W.E. 10,000 ohm 4 watt W.W. 3" Shaft
C.T.S. 10,000 ohm Carbon ⅜" Shaft
Mallory 20,000 ohm 4 watt W.W. 1" Shaft
Mallory 25,000 ohm 4 watt ¾" Shaft
Clarastat 40,000 ohm 3 watt W.W. 1½" Shaft
Centralab 100,000 ohm carbon 2" Shaft

29¢ EACH

Any 12 above, 12 for $2.50

Extension phone cords with plugs 6 ft. $0.25

Extension microphone cords with switch and plugs, 7 ft. $0.25

Kit of Relays, excellent assortment .... 5 for $2.50

Kit of Rotary Switches, Mallory, Centralab, etc. .... 5 for $1.00

4.3 Mc. IF Transformers, double slug tuned .... 25c, 5 for $1.00

We will ship C.O.D.
No order under $2.00

THE HEATH COMPANY
BENTON HARBOR MICHIGAN

The BEST in SURPLUS

HEATHKIT 5" OSCILLOSCOPE

Complete kit to build a beautiful 5" scope, cabinet, chassis and panel punched, formed and lettered. Every part supplied, including tubes with 5BP1, cased power transformer, oil condenser. Frequency compensated amplifier, 15 to 30 M cy. sweep, all controls, blueprint and instructions. This kit makes an excellent training course.
Complete.........**$39.50**

OIL FILLED CONDENSERS

Bargain Prices on G.E., Pyranol, C-D, Solar, etc

CAP	W.V.D.C.	PRICE	CAP	W.V.D.C.	PRICE
4	500	**$ .49**	4	1000	**$ .90**
5	600	**.59**	8	1000	**1.00**
8	600	**1.00**	8-8	1000	**1.95**
2.5-2.5-5	600	**1.50**	8	2000	**1.95**
5-5-5	600	**1.95**	4	2000	**1.50**
8-8-8-8	600	**3.95**	2	2500	**1.95**
5-5	600	**1.00**	.05	7500	**2.50**

Write for list of high voltage condensers.

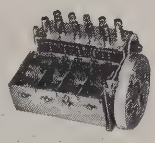
PE 103A POWER UNIT

A 6 and 12 volt dynamotor complete with relays, filters, circuit breakers, switches and cables, supplies 500 volts at 160 mills. Ideal for mobile P.A. systems and transmitters. Lowest price ever offered.............**$6.95**

KITS

Kit of ten ceramic variable air trimmers, 12 M.M.F. to 50 M.M.F.		**$1.95**
Kit of assorted mica and silver mica condensers, all marked	**25 for**	**1.00**
Kit of assorted ceramic condensers	**20 for**	**1.00**
Kit of Potentiometers long shafts, 6000 ohms to 200M ohms	**10 for**	**1.95**
Kit of tube sockets, miniature, loctal, octal	**20 for**	**1.00**
Kit of power rheostats, 25 and 50 watt	**6 for**	**2.95**
Kit of 4 Dynamotors, easily converted to motors for fans, movie projectors, toy sets, etc.	**4 for**	**4.95**
Experimenter's Kit, a paradise of condensers, coils, transformers, resistors, etc., all useful parts	**5 full pounds for**	**1.00**
Resistor Kit, ½-1-2 Watt, all excellent sizes, color coded	**100 for**	**1.95**
Kit of Microswitches	**3 for**	**1.00**
Kit of amphenol connectors, excellent for converting military sets	**10 for**	**1.00**
Kit of bypass condensers, .01 to .25 MFD, 200 to 600 volts, all marked	**15 for**	**1.00**
Kit of toggle switches, SPDT, SPST, DPST, etc.	**6 for**	**1.00**
Kit of vitreous resistors, 5 and 10 Watt	**15 for**	**1.00**
Kit of Selenium Rectifiers	**4 for**	**1.00**
Kit of transmitter crystals, assorted between 2000 and 6000 KC in holders	**4 for**	**1.00**
Kit of R.F. Chokes, excellent assortment	**10 for**	**1.00**
Kit of power, microphone and headphone cords, rubber covered, with plugs	**10 for**	**2.95**

PUSH BUTTON TUNER



A ten push button assembly, operating a 4 gang silver plated variable condenser. Each shielded section has silver plated APC type ceramic air trimmers. Drum dial manual tuning. An outstanding surplus value at lowest price ever offered...........**$2.50**

TEST EQUIPMENT

Signal Generator—Measurements Corp. 78B standard signal generator, covers 2 bands between 15-250 megacycles, new cost $310.00, our price only slightly used	**$39.50**
BC221 Frequency Meters, cannot be told from new, complete	**29.50**

Send for Test Equipment List

METERS

Weston, 2½ 0-60 amps DC, incl. shunt	**$2.95**
Westinghouse, 2½ 0-240 amps DC, incl. shunt	**2.95**
G.E. 3½ 50-0-50 amps DC	**2.95**
Triplett Model 321 0-300 MA.	**3.45**
Weston output meter 2" in wood case, used	**1.00**
Ammeter 0-6 amps 2" Flg. Mtg.	**1.00**
Simpson 2½ 0-3V DC.	**1.95**
Weston Model 507 2½" 0-1 amps RF	**2.45**
Meter Kit containing one R.F. Ammeter, one D.C. Voltmeter and one D.C. Milliameter. Removed from air craft radios	**4.95**

Send for Meter List

RG-8/U FLEXIBLE COAXIAL CABLE

RG-8/U is the ideal cable for feeding receiving and transmitting antennae for all frequencies up to 250 mc, and can be used up to 3,000 mc and down to dc. Priced at less than WAA wholesale. This is the last big lot—order while available.

4c *PER FT.*

MICA TRANS. CONDENSERS

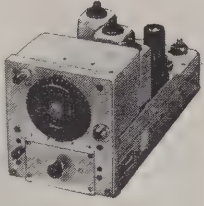
CAP	W.V.D.C.	PRICE	CAP	W.V.D.C.	PRICE
.002	6000	**$3.49**	.005	1200	**$0.39**
.0002	5000	**1.49**	.02	1200	**.59**
.0001 ±2%	3000 A.C.	**.75**	.01	1200	**.39**
.002	2500	**.69**			

Send for list on high voltage micas.

BC 223 TRANSMITTER

One of the most desirable military transmitters, 4 crystal-controlled frequencies and master oscillator. Meters for Osc., Ant., and total current. Uses 46 speech amplifier, 2-46 modulators, 801 each as oscillator and power amplifier. Practically no conversion necessary, plug in crystal, mike and connect power supply and it's ready to operate Brand new, with tubes and tuning units........................**$14.95**

BC 455B RECEIVER



Six-Tube Western Electric superheterodyne. 3 gang condenser, R.F. stage, two I.F stages, tunes 6-9.1 MC Offered brand new in original carton for the price others ask for used war-weary sets with six new tubes 3-12SK7, 1-12SR7 1-12A6, 1-12K8.
Our price........**$4.95**

Dynamotor for BC455B
Each........**$1.95**

TUBES

New Bulk Packed

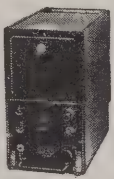
6SN7	6H6	6J5
6SJ7	6J6	1G6G
6SL7	6AQ6	1LH4
6SA7	6AK6	12C8
6A6	3A4	1619
6Y6	955	

49¢

3B7/1291 V.H.F. Twin Triode	**$1.50**
3D6/1299 V.H.F. Tetrode	**1.50**
814 Transmitting Beam Power	**3.95**
6AC7, 6AG7	**.89**

SEND FOR TUBE LIST

BC-605 INTERPHONE AMPLIFIER



The famous tank interphone thousands bought for intercommunicating systems, call systems, etc. Uses two 1619 tubes (2.5V fil. 6L6's) used, in excellent condition, lowest price ever offered, with tubes.....**$2.95**

SPECIALS

455 KC slug tuned I.F.'s square can	**39¢, 3 for**	**$1.00**
4-gang 147 MMF silver plated variable condensers, long shaft, a buy at		**1.00**
Ceramic variable condensers, 50 MMF. Screw driver adj.	**Special 5 for**	**1.00**
Choke, 20 henry 50 MA, cased		**1.00**
Choke, 10 henry, 200 MA, cased		**1.50**
HS30 miniature type headphones, similar to hearing aids with band and cord		**1.00**
12 MFD 150V Mallory electrolytics, extra special	**6 for**	**1.00**
8 MFD 450 Volt Illinois Cond. electrolytics	**3 for**	**1.00**
Power Transformer, 110V 60 cy. pri. from Hammarlund Super-Pro, cased, supplies 465V at 160 MA, 300V bias at 11MA, 6.3V at 7.5A, 5V at 3A, and 5V at 2A. Ideal for PA systems and quality amplifiers		**4.95**
Power Transformer, 110V 60 cy. pri., General Trans. Corp., cased, 500V at 25MA, 6.3V at 3.25A, 5V at 2A.		**1.49**
.01-600V paper tubular condensers	**20 for**	**1.00**
.05-600V paper tubular condensers	**15 for**	**1.00**
16 position rotary switch with knob		**.59**
Interphone control box, BC606, contains potentiometer, pilot lite, switch, etc.	**2 for**	**1.00**
Tuning Unit, BC-746, contains receiver ant. coil, tuning condenser, and crystal, transmitter crystal, slug tuned tank coil sockets, etc. Ideal foundation for Walkie-Talkie or small amateur rig		**1.00**
Dynamotors, Western Electric, 12V input, 220V at 80MA output in original carton		**1.95**
Dynamotors, Western Electric, 24V input, 220V at 80 MA output in original carton		**1.50**
Dynamotors, BD-77, 12V input, 1000V at 350 MA output		**7.95**
Circuit Breakers, G.E., 50 Amp. 220V 2 pole, in original carton		**2.95**
Lip Microphones in original sealed cartons		**1.00**

Free A T 30 throat microphone with each order of over $10.00.

NO ORDER UNDER $2.00 . . . . WE WILL SHIP C. O. D.

The HEATH COMPANY

BENTON HARBOR, MICHIGAN

Whether
RADIO AMPLIFIER or QUANTOMETER

PHOTO COURTESY RADIO STATION WOR & WESTERN ELECTRIC

Cannon Electric Type DPB Connector using gold-plated contacts in Studio Control Booth Console, Type 120 Amplifier in the low level side. Plug-in connector greatly increases ease of servicing and maintenance.

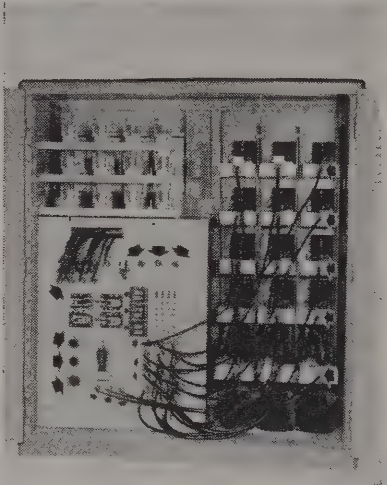
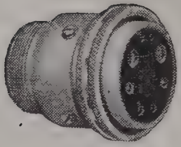


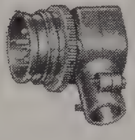
PHOTO COURTESY APPLIED RESEARCH LAB., GLENDALE, CALIF.

Arrows point to Cannon Electric Type "K" fittings connecting a maze of circuits on the Quontometer, a direct-reading spectometer which determines chemical analysis of metals in 45 seconds. Rear view shown.

Plug-in with
CANNON PLUGS



K-21 Plug



RK-24C Plug

TYPE "K"—made in 3 general shell types with nearly 190 insert arrangements available for a wide variety of wire sizes, including coaxials.

TYPE DPB—rack type pin and socket assemblies (both for fixed mounting) carry standard, coaxial and twinax contacts. Six basic layouts available in DPB, many more in the larger DPD shell size.

NEW EDITION C-46-A CATALOG—For a complete survey of the majority of Cannon Electric products, send for this C-46-A Catalog, containing prices on many items. Also included are the names and addresses of our distributors. Write Department J-228.

CANNON ELECTRIC
DEVELOPMENT COMPANY
3209 Humboldt Street, Los Angeles 31, California
Canada & British Empire—Cannon Electric Co., Ltd., Toronto, Ontario • World Export Agents (excepting British Empire) Frazar & Hansen, 301 Clay St., San Francisco 11, Calif.

place directly across the condenser being substituted.

The crystal detector circuit uses a Philmore "fixed" crystal detector and is designed for signal tracing r.f. circuits. The output may be heard either through a pair of earphones or by means of an audio amplifier with a small speaker. The phones or amplifier are connected from the pin jacks at the top of the box. In signal tracing the first tank circuit the rectified signal will be weak or not heard at all since it is not amplified at this stage. To remedy this situation the receiver should be connected to a strong outside antenna. When working with the crystal detector signal tracer circuit, this will strengthen the signal and allow it to be heard in the headset or amplifier. Of course one of the input test leads should be connected to ground and the other probed back progressively from antenna primary to the detector of the receiver being tested.

The buzzer circuit is used for signal injection at various stages of the receiver being tested to locate "dead" stages or points where the signal is being blocked. In this case one lead is grounded to the set and the other probed back from speaker voice coil to antenna. The output of the buzzer can often be effectively used to actually "blow open" stubborn intermittents since the signal generated is very strong, irregular, and choppy, thus producing a great variation of frequencies and harmonics. By placing the lead at the mixer grid of a superhet, the i.f.'s can be aligned with good results and maximum response. The volume control in this circuit is used as an "on-off" switch and an attenuation control when aligning the i.f.'s. A sensitive receiver should pick up the generated buzzer noise without the leads being connected to the instrument. In this way you can determine the sensitivity of a receiver by slowly moving the instrument away from the receiver while the buzzer is on. This is especially helpful when a location, such as tall buildings with a steel framework, is suspected of shielding radio signals.

This handy test unit is housed in a box, which may be of any suitable size, but large enough to accommodate the battery and buzzer.

After the unit has been completely wired and before the cover of the box is fastened down, cotton should be packed around the buzzer in order to muffle its sound. The usable signal should be that which is picked up from the end of the test prod. Four rubber cushions or grommets should be used to support the bottom of the box in order to eliminate, as much as possible, vibrations which might occur when the buzzer is being used. The battery used to power the buzzer is an ordinary 1½ volt dry cell. The cover of the buzzer should be removed leaving the coils and vibrating hammer exposed, thus when the box is stuffed with cotton the buzzer will operate without noise.

POWER TRANSFORMER

1600v-0-1600v, 350 ma. Gov't rating. 7x6½x5½—31 lbs.................... **$12.95**

R·H·S

SPECIALS OF THE MONTH

G.E.—Rotary Switch, 2 deck—each deck SP3P Mycalex wafers. Can be used in Hi-frequencies up to 250 Mcs. Perfect for band switching in an exciter or final. Heavy silver plated spring contacts. Positive action by spring controlled roller bearing. **$1.29**

TRANSFORMERS—115v 60 cyc

Hi-Voltage Insulation

1600v @ 4ma; 700VCT @ 150ma; 6.3v @ 8a..	$8.50
2500v @ 10ma......................................	6.50
3710v @ 10ma; 2.5v @ 3 amp; 2.5v @ 3 amp..	9.95
3950v @ 4ma; tap at 1250v @ 1ma.........	7.50
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500-0-500v @ 100ma; 5vct @ 3a...........	4.95
442-0-442v @ 1000ma........................	9.95
425-0-425v @ 150ma; 6.3v @ 7.5a; 6.3v @ 3a; 5v @ 3a..................................	5.95
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350-0-350v @ 150ma; 6.3v @ 6a; 5v @ 3a; 78v @ 1a	4.95
350-0-350v @ 35ma—XLNT for Volt Doubler	1.49
300-0-300v @ 65ma; 2X-5v @ 2a; 6.3v @ 2½a; 6.3v @ 1a....	3.49
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2.5v @ 3a, 15KV test........................	3.95
2.5v @ 10a, 10KV test........................	3.25
5v @ 115a....................................	14.95
5v @ 190a....................................	17.50
6.3v @ 6.6a..................................	3.25
6.3v @ 3.1a..................................	1.95
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HI-VOLTAGE INSULATION

4 Hy @ 250ma....	$1.98	12 Hy @ 300ms....	$3.95
10 Hy @ 250ma....	2.49	15 Hy @ 100ma....	2.95
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12 Hy @ 100ma....	2.95	30 Hy @ 70ma....	1.95
4 Hy @ 600ma....	5.95	.1 Hy—5 amps.....	6.95

SCR-522 100-156 MC.
RECEIVER AND TRANSMITTER

Licensed for Railway and Taxicab Use

The ideal all-purpose transmitter-receiver for work in the 100-156 mc. spectrum. Four channel push-button operation, crystal-controlled, AM, phone, mobile or fixed station service Ideal for amateur, aircraft, marine, railroad, taxicabs, police and experimental. Amplitude modulated—High transmitter output. Receiver has 10 tubes and transmitter has 7 tubes including two 832's. Easily converted to full 110 volt 60 cycle operation. Complete conversion instructions and schematic furnished with each unit

Tube complement 2—832; 3—12A6; 1—6G6; 2—6557; 1—12J5GT; 1—12C8; 1—9002; 3—9003; 1—12AH7GT and 3—12SG7.

Complete with tubes.............. ....**$14.95**

BC-348 RECEIVER

Built for continuous duty, this band switching, six band receiver with a freq. range of 200 to 500 kc. and complete 1500 kc. to 18,000 kc. Has automatic noise compensator—constant sensitivity on all bands—output at 300 or 4000 ohms—xtal filter AVC-MVC-BFO; Smooth vernier tuning; 90 turns of tuning for each band Complete with built-in dynamotor for 28 v DC. 8 tubes. Conversion instructions and schematics. Wonderful buy at........................**$49.50**

Conversion kit for 110v-60 cyc. operation, complete......................................$7.50

'SILVER BALL' ANTENNA SWITCH

100 Amp. 2500 V. Navy Rating

Terrific Buy $1.79

BLOWER

Hi-air blast, designed for transmitting tube service. Motor operates on 100-125v 60 cycle at 7000 RPM. Noise free with self contained chokes and filters. Enclosed in satin finish, aluminum cabinet. Measures 4" high x 2¾x3¼" Many uses.

Super buy at $5.95

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for
CATHODE RAY TUBES

3" Shield..........................	$1.49
5" Shield	1.98

TUBES (*Brand New*)
Army-Navy Inspected

1B24....	$13.95	311.....	$ 5.95
2AP1....	2.25	371B....	5.95
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5CP1....	3.95	804.....	9.95
5JP1....	9.95	805.....	3.75
5LP1....	9.95	806.....	14.95
5R4GY..	.98	807.....	.95
5Y3.....	.59	808.....	2.95
6AB7 ...	.99	809.....	1.50
6AC7....	.99	810.....	3.50
6AG5....	.99	811.....	1.95
6AG7....	.99	812.....	3.95
6AJ5....	1.89	812H....	6.95
6AK5....	.90	813.....	5.95
6AL5....	.99	814.....	4.45
6AR6....	1.29	815.....	3.95
6B4G....	1.29	826.....	2.25
6C4.....	.69	829-A-B.	3.00
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6F6.....	.89	833A....	49.50
6F6G....	.59	834.....	2.95
6J4.....	1.50	835.....	2.95
6J5.....	.59	836.....	1.75
6J6.....	.89	837.....	2.50
6L6.....	1.25	838.....	3.75
6L7.....	.98	841.....	1.20
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6SH7....	.59	866.....	.99
6SL7....	.89	872A....	2.50
6SN7....	.69	884.....	1.10
6SR7....	.89	885.....	1.10
7A4.....	.95	902.....	2.25
7F7.....	1.25	913.....	3.00
7L7.....	1.59	954.....	.75
9JP1....	14.95	955.....	.75
10Y.....	1.50	956.....	.75
12X3....	1.50	957.....	.75
15E.....	1.50	958.....	.75
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up to 18v A.C.	up to 12v D.C.	15 amp....	9.95
up to 18v A.C.	up to 12v D.C.	30 amp ..	14.95
up to 36v A.C.	up to 28v D.C.	1 amp. ..	3.45
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up to 36v A.C.	up to 28v D.C.	10 amp...	12.95
up to 36v A.C.	up to 28v D.C.	15 amp...	18.95
up to 115v A.C.	up to 100v D.C.	.25 amp....	2.95
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up to 115v A.C.	up to 100v D.C.	5 amp. ..	19.95

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4000 mfd.—18WVDC..........................	$1.95
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OIL CONDENSERS:
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4mfd.	600v ...	.60	4mfd.	2000v ...	3.75
8mfd.	600v ...	1.10	15mfd.	2000v....	4.95
10mfd.	600v....	1.15	.1mfd.	2500v....	1.25
1mfd.	1000v....	.60	25mfd.	2500v....	1.45
2mfd.	1000v....	.70	.5mfd.	2500v....	1.75
4mfd.	1000v ...	.95	05mfd.	3000v ...	1.95
8mfd.	1000v ...	1.95	.1mfd.	3000v....	2.25
10mfd.	1000v ...	2.10	25mfd.	3000v....	2.65
15mfd.	1000v ...	2.25	.5mfd.	3000v....	2.85
20mfd.	1000v ...	2.95	1mfd.	3000v....	3.50
24mfd.	1500v....	6.95	12mfd.	3000v....	6.95
.25mfd.	2000v....	1.05	2mfd.	4000v....	5.95
.5mfd.	2000v....	1.15	1mfd.	5000v....	4.95
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SCR-274-N COMMAND SET

This unit consists of 3 receivers, 2 transmitters, 4 dynamotors, 1 modulator, 2 tuning control boxes, 1 antenna coupling box with RF ammeter, antenna relay and 5000v., 50 mmfd. W.E. vacuum condenser. Also complete set of 29 tubes with each unit. The receivers cover frequencies of 190-550 Kc; 3-6 mc; 6-9.1 mc; a calibrating crystal is also included. Each receiver has its own dynamotor and another dynamotor powers the transmitter and modulator. Terrific Value. Complete, ready to operate......................... **$39.00**

NEW SOCKETS

Type 212 for RCA 833 or 833A. Type 234 for Western Electric 5D21, 705A, 715A, 715B. Raytheon RKR72 and RK72. Steatite base and special locking device for retaining tube in socket. Type 212. Net Price Each................. **$4.67**

Type 234. Net Price Each. $1.07

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If you're looking for "down-to-earth" values in communications receivers, SHOP AT FEDERATED! We maintain one of the largest, most complete stocks of standard brand receivers in the country. You're sure to find the set you want, in our stocks . . . and our competent, friendly technical personnel is at your service, to help you choose wisely!

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Pay 20% down, balance in twelve monthly payments. Get the set you want now . . . pay for it later.

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All Available for Immediate Delivery

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Model	Cash Price	Down Payment
S-38	$ 47.50	$ 9.50
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SX-42	275.00	55.00
SP-44	99.50	19.90
HT-9	350.00	70.00

NATIONAL

NC-46	$ 97.50	$19.50
NC-173	179.50	35.90
I-10A	67.50	13.50
NC-240D	225.00	45.00
HRO	274.35	54.87

HAMMARLUND

HQ-129X	$161.40	$32.28
SPC-400X	334.05	66.81

RME

VHF-152	$ 86.60	$17.32
RME-84	98.70	19.74
RME-45	198.70	39.74

MEISSNER

Signal Shifter	$99.50	$19.90

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Four black pin jacks and six red ones were set into the wooden cover. All of the components, including the condensers, crystal, and jacks, are mounted under this cover with the exception of the buzzer which is not fastened to the case in any way but merely lies on the cotton stuffing where it can operate freely without causing any unnecessary noise.

A multiple click switch, if one is available, can be used to eliminate the necessity for changing the test leads. This set-up is especially recommended for the condenser combination.

This entire unit was built in less than two hours and cost only $1.65 for parts. With this gadget it is possible to check receivers without using any other type of test equipment. —30—

RADIO REUNION

BY MAJOR HAL CONNER, USMC

"THIS is W6YB in Oceanside calling."

U. S. Marines in amateur radio stations throughout the Pacific hear these words each day and know that Marine Warrant Officer Charles D. Pierce of Camp Pendleton, Oceanside, California, is about to melt the 6000 miles separating Leathernecks from their families.

For over two hours each night Pierce sits at the microphone of his living room radio station in his home in Oceanside, California, and talks to Marine operators on Guam, Saipan and Hawaii.

Usually present at these broadcasts are the wives and children of Marines stationed there, who use Station W6YB to hold family reunions by radio. On other occasions, Camp Pendleton Marines and their families exchange news of local events with families stationed overseas.

Since he began operation of his radio station several months ago Pierce has contacted over 200 amateur broadcasters throughout the world.

Pierce built the transmitter himself. The first station that he talked to was operated by two G.I.'s occupying Japan. Most of the Marine's broadcasts are done on a regular nightly schedule with Guam, Saipan and Hawaii, although he often makes contact with amateur radiomen in China, Australia, the Marshall Islands, and other points.

The Camp Pendleton warrant officer, who is in charge of the low-speed radio operator's school here at the world's largest Marine training center, is an ex-prisoner of war. He was caught by the Japanese in Peking, China, when World War II started and spent nearly four years behind barbed wire in Shanghai and Kyushu, Japan.

Fourteen years ago, Pierce enlisted in the Marines. When he left "boot camp" at Parris Island, S. C., he was assigned to signal duty and has been a communicator ever since. He first went to China in 1934, where he was on duty as a radio operator at the American Embassy in Peking. Later, in 1938 Pierce was put in charge of the Marine amateur radio station on Guam and was there until shortly before December 7.

The Warrant Officer stated that he could talk to stations in Europe and the eastern United States only when it's daylight there. Early evening has proved to be the best time to contact Guam and Saipan inasmuch as it is noon the following day there.

"This is W6YB signing off."

When "Jack" on Saipan, "Joe" on Guam and "Stan" on Hawaii hear these words and close down their short-wave station they know that "Charlie" in Oceanside has made a lot of Marines happy by reuniting families, who otherwise would have had an ocean between them.

—30—

Marine Warrant Officer Charles D. Pierce, W6YB, provides radio reunions for Marine pals.

The LOG of AMATEUR RADIO STATION

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DOUBLY SEALED AGAINST HEAT and MOISTURE

Sprague High-Voltage Paper Tubular Vibrator Condensers are especially designed *in every respect* to stand the severe conditions of auto radio operation. They're oil impregnated against intense heat. They're over-all wax dipped—and they've got special end seals for really top notch humidity protection. The working voltage rating of 1600V. D.C. is honestly conservative. Capacity ratings mean exactly what they say.

Use 'em on all auto radio jobs—and other high-voltage applications as well. They'll stand the gaff! They will not let you down!

As always, we'll appreciate it if you order them by name—*Sprague Type TR High-Voltage Paper Tubulars.*

SPRAGUE
VIBRATOR
CONDENSERS

FOR SALE—Philco table model receiver with speaker and tubes. Robert Rouse, 57 Water St., Geneva, Ohio.

WANTED—New or used Hallicrafter HT-6 transmitter. State price and condition. Les. Allen W2QOK, 25 S. Warren St., Trenton, N. J.

FOR SALE—RME DB-20 preselector in perfect condition. Used only 3 months, $55 prepaid. C. W. Wade, W5MKL, 1605 Palm Drive, Corpus Christi, Texas.

WANTED — Transformer similar to Stancor P-6318 that will deliver 250 and 400 volts at 200 ma. simultaneously. Cash or trade. Charles B. Remer, 838 Riverside Drive, New York 32, N. Y.

FOR SALE — Millen 50-watt transmitter, 90800, in black table cabinet with r-f ampmeter, tubes, xtal and coils, but less power supply, $50. Also Navy TBY-8 transmitter receiver and 6v power supply, $25. F. Laughlin, 1040 Persia Ave., San Francisco 12, Calif.

FOR SALE—Prewar parts, 375-watt 4—20-10 meter c.w. transmitter—all good parts. Breting 12 receiver good condition. Reasonable. D. Shaw, 126 Elam Parkway, Lexington, Ky.

FOR SALE—Hallicrafters S-38 receiver in A-1 shape used only 3 months. Has wiring diagram. $40. Antone L. Oliveira W1PWL, 94 Potomska St., New Bedford, Mass.

FOR SALE—R.M.E. 69 receiver good condition, complete less speaker; 838 tube never used but out of carton. Clarence A. Resch, Jr., W0FTD, 1214 West Maple Ave., Independence, Mo.

SELL OR TRADE—Holmes 16mm "H" projector complete with screen. Used only 30 days. $490 or will take Meissner analyst and precision tube checker as part pay. J. A. Quarles, R 7, Box 78, Pine Bluff, Ark.

FOR SALE—Radio magazines and books; over 500. Write for list, Hillery, W2GNK/9, Elmwood, Ill.

WANTED—S22R receiver. State price and condition. Would like to trade 10 volume set The Complete Photographer for radio books or what have you? Paul W. Kercher, 119 North St., Elkton, Md.

FOR SALE—Meissner B-150 transmitter with signal shifter, spare parts, data for conversion to 10-20 meters. Local buyers preferred, $325. John J. Gillen, W3NFG, 2329 St. Albans St., Philadelphia 46, Pa.

WANTED—Communications receiver HQ129X, HQ120, SX25, SX28A, S40 in good condition. W. Littenberg, 731 Greenwich St., New York 14, N. Y.

WILL TRADE—National NC44 receiver and separate speaker in cabinet for good quality service oscillator in good condition or will sell for $50 cash. George Moore, W3PFD, 907 14th St., Beaver Falls, Pa.

WANTED—Good used Hickok 49225 jumbo voltohmmilliameter. A. J. Welter, Gonvick, Minn.

WILL TRADE — Complete Candler code system consisting of both beginners' and high-speed courses. Want transmitter parts. All letters answered. Daniel D. Lewis, 101 Constitution St., Emporia, Kans.

WANTED—Meissner 14-tube traffic master communications or similar receiver. State price and condition. R. E. Bond, 49 NE 110th St., Miami, Fla.

WANTED—Meissner 14-tube Traffic Master communications receiver or similar. State price and condition. Bond, 49 NE 110th St., Miami, Fla.

FOR SALE—BC-406 with speaker, for 110v. operation; 13 tubes inc., perfect condition. Partly converted for 5, 10 and 20 meters. Has heavy steel case. $35 with speaker, line cord and plug. Peter H. Parkhurst, 2207 Shore Rd., Northfield, N. J.

FOR SALE—New 7-tube super-heterodyne, built as shown in 1946 Handbook. Complete with power supply, speaker, 80, 40, 20 and 10 meter coils and 21 x 21 wooden rack. Exceptional value $25. B. E. Martin, 25 Martling Ave., Pleasantville, N. Y.

WILL TRADE—0-5 G-E r-f meter never used, for good used bug, any make. Hartwell B. Burner, W0OEL, Mayville, N. Dak.

WANTED—Used SW receiver in good condition. Give complete description and price. H. L. Spence, Gen. Del., Winston-Salem, N. C.

FOR SALE — 40-watt rig without tubes, power supply, crystals but with all plug-in coils for 40-80 meter band, $15. Monitor $3. F. Bou, W3ESX, 3131 N. Percy St., Phila. 33, Pa.

FOR SALE — RME-69 with black crackle matching speaker in excellent condition. $100. W9LNQ, 6311 W. Grand, Chicago 39, Ill.

WANTED—HW-120X receiver in good condition. Will pay cash. Robert R. Payne, 145 Highland Drive, Williamsville 21, N. Y.

FOR SALE — National NC-46 with speaker good condition. Looks like new, $80. John Jacezko, 4030 N. 9th St., St. Louis 7, Mo.

FOR SALE—Code practice machine in red leatherette covered case, complete with tapes, key, buzzer and batteries. Very good condition, $10 postpaid. Vern Anderson, 304 Pine, Lewistown, Mont.

WANTED—FM and AM receiver R44/ARR-5S. Harold Francis, % Manasquan Police, Manasquan, N. J.

FOR SALE—Communications receiver, Navy surplus RAO-6 (same as NC-100XA except for additional T.R.F. stage). Standard coverage, 540kc to 30mc. Little used, $80. H. Davies, 36 Jefferson Ave., Hasbrouck Heights, N. J.

FOR SALE—Supreme oscilliscope No. 530 with complete instructions. Good condition, $35. L. K. Drum, 785 Mt. Vernon, Lake Orion, Mich.

WANTED—BC342 receiver or equivalent, Vomax, or first class tube tester. Will trade Winchester 54, .30-06 rifle with Redfield peep sight, sling, and ammunition. Complete descriptions exchanged. W4BVZ, Needham C. Crow, 312 Johnson St., New Bern, N. C.

FOR SALE—BC348 receiver for 100v, 60 cycles a-c with many improvements. $65. James E. Kietzer, 2035 West Berwyn Ave., Chicago 25, Ill.

WANTED—Good used signal generator covering standard and short wave bands. Must include instruction manual and be reasonably priced. W. H. Davidson, Pendleton, Ore.

FOR SALE OR TRADE—McElroy 60w transmitter-exciter, built in eco, and all coils. Excellent condition. Also dual power supply. Need 15-25 watt amplifier, signal generator, 1800v, 300ma transformer or what have you? G. H. Perry, W5LVX, Box 6743, L.S.U., Baton Rouge, La.

FOR SALE—Signal corps radio receiver BC-348-R converted for 110v. use; complete with speaker $67.50. Charles Markham Morris, P.O. Box 294, Bastrop, La.

SELL OR TRADE—Transformers, output, mike and vibrator, various tubes, 1N23 crystals. O. John Zethmeier, 1123 Woodycrest Ave., New York 52, N. Y.

FOR SALE—BC-191, 150-watt phone/CW 40/80 meter transmitter easily changed to include 10/20 meters by altering coils, with 4 plug-in coils and 12 volt dynamotor, $60. R. Shibe, 1103 Grandview Blvd., Kansas City, Kans.

TRADE—Class C airplane engine like new, 2 propellers, fly-wheel, coil, condenser, battery box and spark plug wrench for ham gear or what have you? Nile Smith, 316 W. Franklin St., White Hall, Ill.

WANTED—Diagram of model 54 General Television radio. Clarence Stinnett, 1721 Elm Ave., Lynchburg, Va.

SELL OR TRADE—Small sensitive relays, 5,000 and 8,000 ohm. Want other radio parts. Melvin Youngman, 515 South Blvd., Oak Park, Ill.

SELL OR TRADE—McMurdo Silver model 900 Vomax, used 3 weeks. Guaranteed — $50 or good portable typewriter or ham receiver. James Lanterman, Box 609, Lake Charles, La.

FOR SALE—ACR-111 (RCA) 16 tube comm. receiver with 12" speaker, covers 550 kc to 30 mc. $130 or will swap and pay difference for SX-28A. Robert F. Lindstaedt, 438-A 14th St., San Francisco, Calif.

WILL TRADE—Hallicrafters S-27 receiver, tuning 27-145 mc. for Hallicrafters S-27-B receiver, tuning 35-165 mc. in working order or repairable condition. Al. Birch, Box 13, Parkland, Wash.

FOR SALE — Eleven 9003 (vt-203) radio tubes (Ken Rad) and adapters for 50L6, 35A6. $5. Williamson Radio Service, Copper, Texas.

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The Sprague Trading Post is a free advertising service for the benefit of our radio friends. Providing only that it fits in with the spirit of this service, we'll gladly run your own ad in the first available issue of one of the six radio magazines in which this feature appears. Write CAREFULLY or print. Hold it to 40 words or less. Confine it to radio subjects. Make sure your meaning is clear. No commercial advertising or the offering of merchandise to the highest bidder is acceptable. Sprague, of course, assumes no responsibility in connection with merchandise bought or sold through these columns or for the resulting transactions.

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(HRU-28) DC POWER SUPPLY
24-28 VOLT at 70 AMPS—2000 WATTS

This unit is just fine for your Field Day, to operate your BC 375, ART/13 Collins trans., BC 348 Rec., and all your gear.

This gasoline engine generator power supply is a one-cylinder, two-cycle gasoline engine, approximately 4 horsepower. Automatic starting when 24-volt battery is attached. Voltage regulator adjustment can adjust from 12 volts to 35 volts, DC. Ideal power supply to operate all war surplus radio equipment (24 volt DC).

These units are slightly used but in excellent condition and guaranteed operative. Each power supply is given an operating test before being shipped. They are substantially crated for domestic shipment. Complete as shown; ready to operate.

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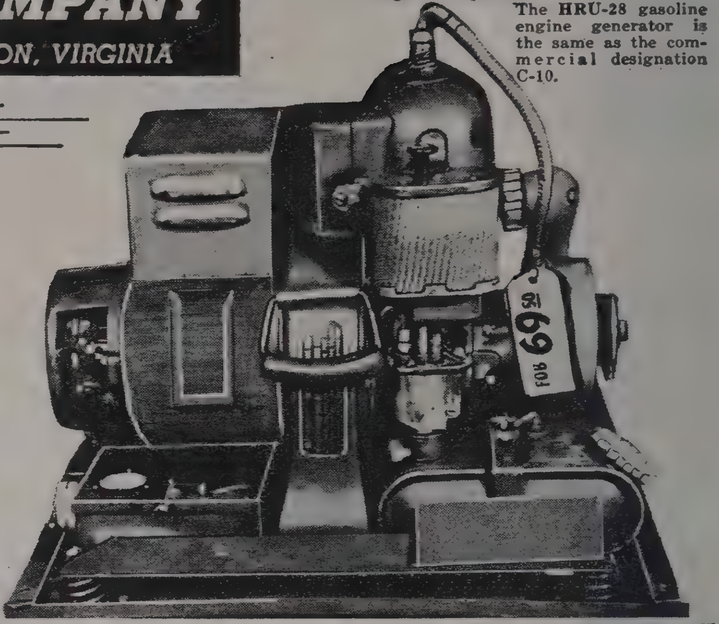
- STARTING AIRPLANE ENGINES
- CHARGES BATERIES (FAST CHARGE)
- FARM IMPLEMENTS
- POWER MOWERS
- WELDERS
- AMATEUR RADIO STATIONS
- BOATS, LIGHT SYSTEMS
- FARM LIGHTING (AUXILIARY)

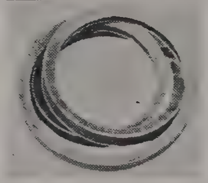
Over-all dimensions: Height 21½ inches. Width 17½ inches. Length 24⅝ inches. Weight 115 pounds.

The HRU-28 gasoline engine generator is the same as the commercial designation C-10.



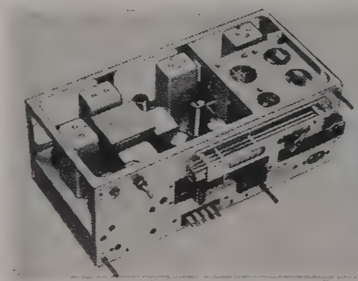
RADIO CONTROL BOX

BC-451. Two microphone jacks, four-position selector switch, telegraph key, and numerous other parts, all for **$1.50**



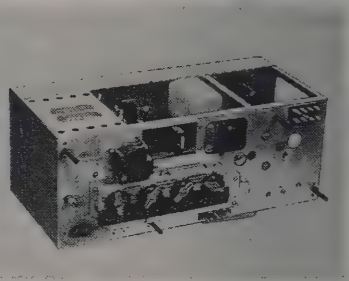
BRAND NEW DIAMOND T BELTS

Length 52″ OD dimensions. Ideal for driving dynamotors and generators and many other special jobs. Special each **$1.00**



BC-624 VHF RECEIVER 2 METER

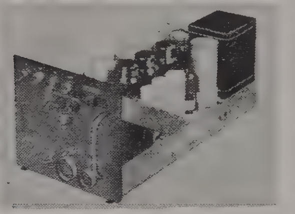
10 tubes, 4 crystal channels, tunes from 100 to 156 mc. Excellent receiver for the VHF experimenter. Does a fine job on 144 mc. Makes basic unit for conversion of FM or television. only **$12.50**



2 or 6 METER RADIO TRANSMITTER BC-625-A

The famous SCR-522 transmitter only, covers from 100-156 mc., crystal control, four crystal channels, seven tubes, two of which are 832's. 8 watts power output, 100% modulation, built-in modulator. Steady, reliable, beautifully made of finest components. Can be made to furnish 50 mc and 144 mc. Can be used as drive for any frequency above. only **$12.50**

APN-4 RECEIVER-OSCILLOSCOPE POWER SUPPLY

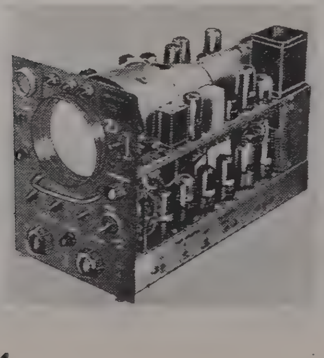


Has four screw driver tuned R.F. channels selected by switch—I.F. frequency 1050 kc, I.F. band width 45 to 60 kc, R.F. frequencies 1600 kc to 2000 kc. Tube lineup: (2) 2Y2, (1) 5U4, (3) 6B4, (1) 6SU7, (1) 6SA7, (4) 6SK7, (1) 6SN7, (1) 6SL7, (1) 6H6 and (1) VR150. The components of this receiver are the finest money can buy. Makes excellent fixed tuner for medium frequency police calls or public address system. Has power supply for 5 inch scope—just the set to make a panoramic scope for those high frequency I.F. receivers—power transformer 400 cycle. Low voltage supply is electronically controlled and delivers 260 v.d.c. 150 mils regulated to .01%. The power supply alone is worth more than the price. Only **$18.25**

GI FOOTLOCKER—ALL WOOD

Hinge and clasp for lock. Ideal for tool chest and storing parts. **$2.75**

APN-4 INDICATOR—PRECISION OSCILLOSCOPE



Special for radio amateurs, experimenters and radio repairmen. This APN-4 scope can be converted into a 5-inch panoramic set with marker pips at 100 kc - 20 kc - 2 kc - that will enable you to observe the crystal and V.F.O. drift and the width of frequency deviation of FM. A precision sweep scope that is accurate. It has within it an electronic switch that enables you to observe two signals simultaneously, and 100 kc lab. type crystal with TPTG oscillator circuit feeding six frequency divider stages. Tube lineup: (1) 5CP1, (3) 6SL7, (14) 6SN7, (6) 6H6 and (1) 6SJ7. Only **$38.50**

Note

All tubes and dynamotors furnished with all units.

T-17 CARBON MICROPHONE

Brand new, $1.85 each. Used $1.00 each.

HS-33 HEADPHONES

Headphone with extension cord approximately 72″ long as shown. 600 ohms, brand new, $1.50 each. Used, each **$.69**

HEADSET EXTENSION CORDS

Approximately 72″ long, rubber covered with JK-26 and PL-55 plugs. Each **$.25**

SAVE TIME! SAVE MONEY!

Free! A book full of schematic diagrams and conversion information on war surplus equipment such as BC-375-E, SCR-274-N, SCR-522, BC-221, APN-4, APN-1 and many others.

R & M Engineering Department has worked out the latest and many new ways to eliminate the worry and headaches of converting surplus equipment. This book contains wiring diagrams of each equipment and conversion information on how to adapt with wiring changes. One of these books *free* with each equipment you purchase. **We have selected the most desirable and choice radio gear and present them to you with a *SATISFACTION GUARANTEE! You save money when you deal with us.***

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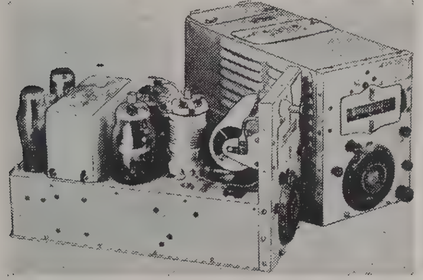
SCR-274-N COMMAND SET COMPANION OR STANDBY

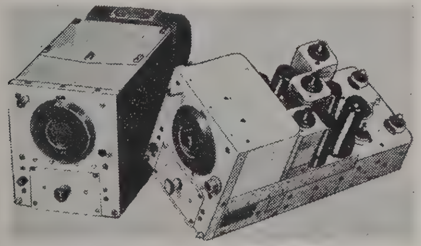
Here are a couple of things you can do with equipment included in the SCR-274-N Command Set. The transmitter VFO driver stage gives you the BC-375-E higher RF output—as high as 150 watts. Make swell standby receivers with the BC-348 on round table "rag chews." Includes all this equipment: 3 Receivers—190-550 kc, 3-6 and 6-9.1 mc; two transmitters, 4-5.3 mc, 5.3-7 mc; four dynamotors—28 volts DC input; 1 modulator with carbon mike input; two tuning control boxes; one antenna coupling box with r-f ammeter; antenna relay and 5000 volt 50 mmfd. WE vacuum condenser (antenna relay can be used with most rigs); and a complete set of tubes for each unit—29 POPULAR TUBES in all. Mechanical cables with tuning receivers supplied for $1.00 extra. Complete diagrams and instructions on other conversions and uses furnished with set.

only **$19.50**



VFO DRIVER—40 WATTS OUTPUT

BC-696-A	3-7 mc	$8.50 each
BC-457-A	4-5.3 mc	$6.00 each
BC-458-A	5.3-7 mc	$6.00 each



BEAUTIFUL SUPER-HET RECEIVERS

Ideal companion or standby receiver for your shack. The following receivers are available:

BC-454	3-6 mc.	$5.50 each
BC-453	190-550 kc.	
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CASE CS-48

Storage case for 375 tuning coils. VERY HEAVY GAUGE ALUMINUM, smooth surface, black crackle finish, 7⅞″ x 16¾″ x 7 29/32″. These cases are tops for all around use as chassis.

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2 METER OR 6 METER RIG

The Army Air Force SCR-522 transmitter-receiver designed to operate from 100 to 156 mc. However, two small changes incorporated will easily convert to 6 meter operation.

When used as mobile unit or ground station, the dynamotor (supplied with set) has complete instructions for conversion to auto engine driven self-excited generator. Also used 115-volt AC, 60 cycle motor drive. Can be converted to FM receiving and transmitting. Furnished complete with transmitter-receiver, dynamotor, remote control box, plugs and tubes.

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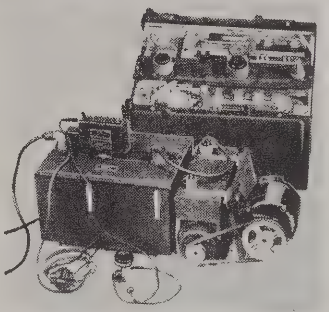

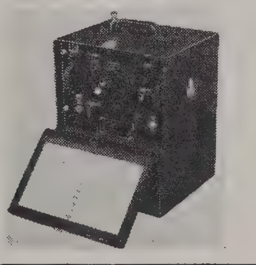

BC-221 FREQUENCY METER

Here's something to add to your equipment. A heterodyne frequency meter complete with tubes and guaranteed accuracy of 0.01% or 500 cycles, whichever is greater. Dial readable one part in 50,000. Better than two dial division per kc. Fundamental ranges are 125-250 and 200-400 kc. Can be used with 110 volts AC power pack batteries, or vibrapack. Makes a fine signal generator—or converts to VFO.

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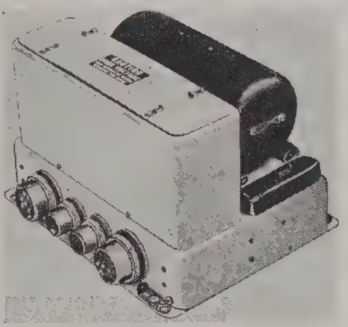
Brand New	**$59.50**
With Modulation	**$74.50**



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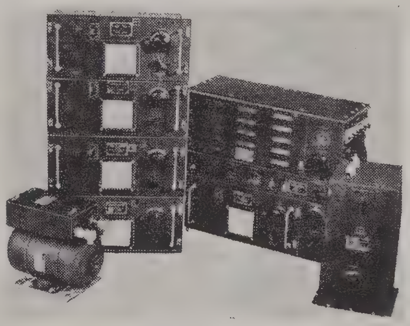
Modulator for Transmitter, High Voltage DC Power Supply.

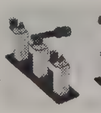
Model unit, BC-456-A or V with dynamotor DM-33-A. Approximate wt. 17 lbs. Tube line-up, 12J5GT, 1625, VR150 and many other parts that make an ideal parts buy besides the above mentioned items. Diagram furnished.

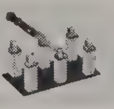
$2.75

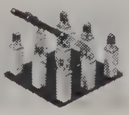


ARMY AIR FORCE BC-375-E TRANSMITTER

It's been written about and talked about—just the thing for beginner or old-timer. Has five tubes, 5 tuning units. Transmitter designed to operate from 200 kc to 12 mc (less BC band). Equipped with antenna tuning unit—BC-306-A—variometer and tap switch. Dynamotor (PE-73-C) complete with relay, fuses and filter. Diagram and instructions for its use supplied with each set. Weight approximately 275 lbs. only **$29.50**







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Short Change Workers

By HAROLD ZIEGLER

You can help stamp out short change rackets by being on the alert for these workers' methods.

THE SHORT CHANGE artists aren't mad at the radio and appliances dealers, and they'll visit you just as quickly and as often as they visit the corner grocery dealer, druggists, and other merchants and dealers.

Short change artists specialize in certain short change manipulations just as other types of criminals stay with their specialty, be it burglary, forgery, picking pockets, shoplifting, etc.

There are more than two dozen totally different forms of the short change racket. This article isn't meant to alarm you, but to acquaint you with the exact manner in which these various short change rackets are worked.

This article is being especially prepared for the readers of Radio News in an effort to prevent future loses by acquainting the radio and appliance dealer with each and every short change racket that has been worked on appliance dealers before and will be worked again.

As you know, millions of people tried to turn into short change artists overnight when the white pennies made their appearance. The government received so many complaints from merchants that they stopped minting them. This should serve as a warning as to *who* would try to short change you.

The following short change rackets are worked by two short change artists, which are usually a man and a woman instead of two men or two women. A customer will be looking around your accessory department and will eventually buy a radio tube or some other small part and will pay for it with a ten dollar bill. The next customer will quickly enter your store or come from another part of your store and will immediately and hurriedly make a small purchase and pay for it with a single.

The customer who gave you the single takes his change and quickly starts for the door. The second you shut the cash register the customer will stall and immediately return to you and say, "Say, I gave you a ten dollar bill and you only gave me change for a dollar."

If you look a little doubtful or hesitate but a second then the customer will press his claim by saying, "I'm positive I gave you a ten dollar bill and I can identify the bill I gave you because I have a telephone number written on it. I wanted to call a cab and I looked the number up in the telephone book at the drug store a few minutes ago, and I wrote the cab number on my ten dollar bill."

The customer may even bring out a fountain pen that has an odd colored ink in it, such as green, red, or purple, and will say that the telephone number is written on the ten dollar bill with that same colored ink. If you accept this as proof enough, then you are going to be short changed for nine dollars because you have a ten dollar bill in your register that has the same telephone number on it that the customer says is on it and the number was written on the bill with the same colored ink that is in the customer's fountain pen but—*it is the ten dollar bill that was given to you by the first customer who has already left the store.*

Naturally, you never suspect that these two customers are working in collusion. If this one is tried on you tell the customer that you can't do anything about the mistake until the register is checked at closing time. You needn't worry about the short changer coming back—they always suspect a trap will be waiting for them.

The *"counterfeit bill"* short change racket pops up occasionally to victimize quite a few retailers in a short period. A woman will enter your store and will pay for her purchase with a new twenty dollar bill, or sometimes an old twenty dollar. She stalls around for a few minutes so you can get a good look at her.

A few minutes after she leaves your store an elderly man will enter and will call you aside and flash a badge or some other credentials and will identify himself as a Secret Service man. He then shows you a picture of the woman who has just left your store or he describes her and asks you if she could have possibly been in your store during the last three or four days.

The "Secret Service man" acts a little excited and pleased when you identify the woman and tell him that the same woman was in your store but a few minutes ago. He now quickly pulls a slip of paper that has some serial numbers and face plate numbers written on it and he tells you that the woman you identified is a notorious passer of counterfeit money and that she has been flooding your section of the country with counterfeit twenty dollar bills.

He shows you the numbers on the

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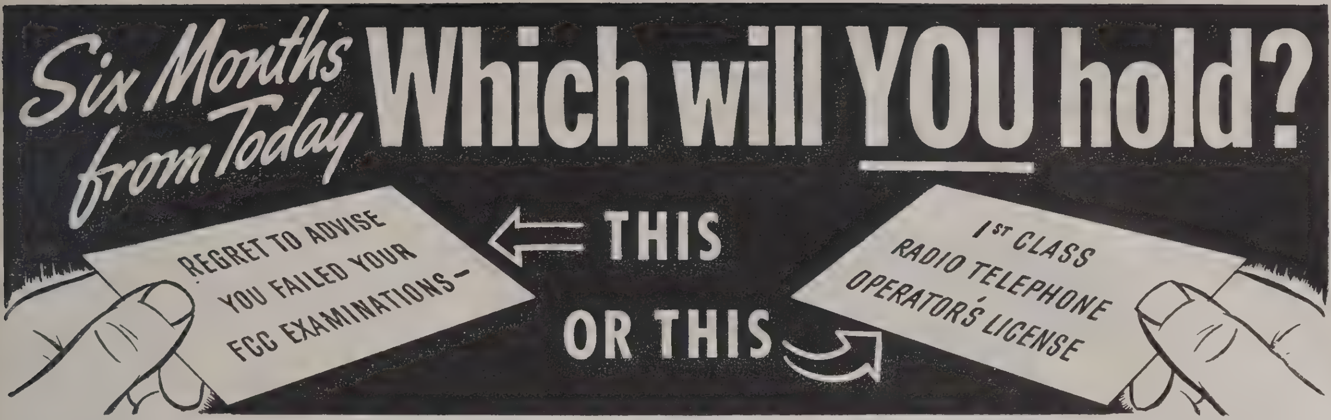
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Get your license without delay. Let Cleveland Institute prepare you to pass FCC license examinations, and **hold the jobs which a license entitles you to,** with CIRE streamlined, **post-war** methods of coaching and training.

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"I have taken the first class phone license examination and received my first class ticket last Saturday, May 31. In closing I must say yours is an excellent radio course, and I really appreciate your help and the fine service you have rendered me."
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FREE BOOKLET—Tells you the Government requirements for all classes of FCC *commercial* licenses. (Does not cover Amateur License examinations.) Use coupon below for Booklet B.

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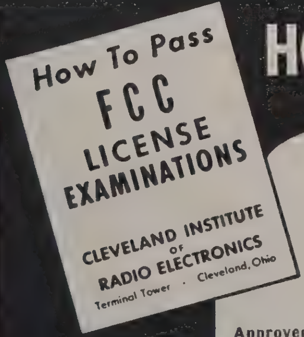
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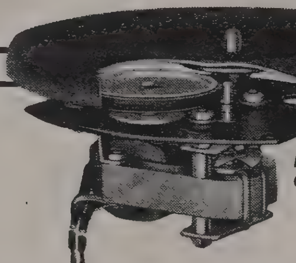

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Send for details. Let us help you select the *right* units for your products from the complete GI line of *Smooth Power* Phonomotors, Recorders and Combination Record-Changer Recorders. Prompt deliveries are now available.

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Output	–5 to +55 Decibels

See Your Jobber or Write for Bulletin 458

CHICAGO INDUSTRIAL INSTRUMENT CO.

536 West Elm Street - Chicago 10, Illinois

slip and tells you that all twenty dollar bills with these numbers on them are counterfeit, and he acts apprehensive as he asks you if the woman possibly gave you a twenty. He asks you to check up on your twenties in the register to make sure. You look at your twenties in the register and to your dismay you see that the twenty on top in your register has the same serial number and face plate on it.

The "Secret Service man" is pleased at this as he tells you the trail is hot now and that the woman couldn't possibly escape arrest that day because a half dozen men from the department have surrounded that particular locality. He tells you he will have to take the counterfeit bill with him to be used as evidence as he writes out a receipt for you.

He tells you that someone from his department will bring a genuine bill to you for the counterfeit that you turned over to him, and he thanks you for your cooperation as he quickly leaves your store to take up the "chase" for the woman.

The woman wasn't a passer of counterfeit money and the man wasn't a Secret Service man—and the bill that you turned over wasn't counterfeit. The bill was genuine but the man and woman were phonies—just a couple of more short change artists. If this one is tried on you tell the make-believe Secret Service man that you turn over all spurious bills to your banker—and then call the police as soon as he leaves your store.

The *"flim-flam"* is worked in the following manner: A customer will enter your store and will ask you to give him a five dollar bill for five singles that he has in his hand. If you oblige the customer he will roll the bills in a small wad when you go to your register for the five. When you give the customer the five he tosses his bills on the counter. At this stage a woman will approach you and excitedly ask you the whereabouts or the address of some former employee. The name she gives you is a fictitious one, and she continues to ask questions about this fictitious employee as she confides that she is from the press and that the employee in question is about to be cited for some act of bravery by the president or is about to be given the Congressional Medal of Honor.

While you have mental pictures of heroes floating through your mind and are racking your brains to figure out which of your former employees she could possibly be looking for—you are still straightening out the bills that the man gave you. When you get them straightened out you notice that the man gave you too much money. He had a five and four singles in his wad instead of five singles.

He acts as though he has just realized too that he gave you too much money. Now he fishes another single from his pocket and tosses it to you and says, "Here's another dollar. Just

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Remaining set of necessary tubes......$16.95

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CONDENSERS

CF 45—.1 mfd—3500 volt DC	$ 1.98
CF 48—.05 mfd—2500 volt DC	1.09
CB 18—.25 mfd—4000 volt DC	2.95
ER25AD—dual 25 mmf per sect. variable condenser	2.04

SOCKETS

11 prong isolant scope socket	$ 0.59
Octal socket	.12
Special hi. voltage socket for 2x2	.59

TRANSFORMERS

TS.6—Scope transformer—2500 v. @ .4 a., 2.5 v. @ 1.75 a., 6.3 v. @ .6 a.	$ 9.95
TS.5—Western Electric—D303184—hi. volt 4200 v. @ 9 ma lo. volt. 640 v. @ 200 ma—fil. 6.4 v. @ 5 a., 5.4 v. @ 3 a., 5.1 v. @ 3 a., 2.5 v. @ 1.75 a.,—complete television hi. & lo. volt. trans. in one compact oil filled unit—will handle any television tube	12.95
TCH 2—Scope transformer 1750 v. @ 4 ma and matching fil. trans 6.3 v. @ .8 a., 2.5 v. @ 1.75 a., 2.5 v. @ 1.25 a.	7.95
HF 16—Filter choke 10 hy @ 150 ma	1.95
LC 2—25 ma R.F. choke	.59

MISCELLANEOUS

Pots—all sizes less switch	$0.69
Pots—all sizes with switch	1.09
Trimmers—single 3—30 uuf	.20
dual 5—50 uuf	.35
13" x 17" x 3" steel chassis cadmium plated	1.95
High voltage wire—50 ft. roll	1.00
Peaking coil	.45

NEW, STANDARD BRAND TUBES

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
1A3	$0.98	12SK7	$0.89	813	$5.95
7A7GT	1.10	12SN7GT	.79	814	4.49
1A4G	.98	12SQ7GT	.99	815	2.25
1L4	1.10	12K8	1.25	826	2.25
1R4	1.29	14B6	.99	828	7.50
1T4	1.10	28D7	.75	829B	3.95
1H5	.99	30	.78	830B	5.25
1N5GT	1.10	34	.98	832	2.25
1LN5	1.92	35Z3	.99	832A	3.95
1R5	1.10	35L6	.99	835	3.00
1S5	1.10	32L7	1.50	837	2.50
3Q4	1.10	35W4	.89	838	3.75
3Q5GT	1.10	37	.69	860	3.00
6AB7/1853	.99	38	.89	7193	.49
6AC7	.99	39/44	.59	8011	4.95
6AG5	.99	41	.69	0Z4	1.25
6AG7	.99	45	.64	2X2	.84
6AK5	.99	46	.65	3B24	1.95
6AL5	.99	47	.90	4C/35	4.95
6AT5	.98	50B5	1.59	5R4GY	1.15
6B4	1.29	50L6	.99	5T4	.98
6B6G	.89	70L7	1.59	5U4	.98
6C4	.64	71A	.69	5W4	.98
6C5	.51	713A	1.65	5Y3	.60
6C21	12.95	954	.75	5Y4G	.59
6C6	.75	955	.75	5Z3	.89
6D6	.75	956	.75	6X5	.89
6F5	.51	957	.75	25Z6	.98
6F7	1.25	958A	.75	35Y4	.99
6F8	1.10	959	.75	35Z5	.99
6G6	1.10	9001	1.15	80	.75
6H6	.59	9002	.98	82	.98
6H6GT	.89	9003	.98	83	.94
6J4	1.50	9004	.98	83V	.98
6J5	.59	9005	.98	84	.90
6J6	.89	9006	.69	217C	7.50
6J7	.80	10Y	1.50	250R	3.95
6K6	.69	15E	1.50	836	1.50
6K7	.79	HF100	6.95	866A	.75
6K8	1.25	HY615	.89	872A	2.25
6L6	1.25	V70D	6.90	884	.75
6L6G	1.20	100TS/	3.00	2050	.90
6L7	.98	2C26A	.75	2051	.90
6N7	1.25	2C34	1.15	RK60	1.25
6R7	.98	2C40	2.60	RK72	3.50
6SA7	.90	2C44	1.75	VR78	.75
6SC7	.85	2J32	20.00	VR90	.75
6SF5	.79	2J33	20.00	VR105	.75
6SH7	.65	211	1.25	VR150	.75
6SJ7GT	.69	2J56	20.00	Z225	1.95
6SK7	.79	3C24/	1.35	874	1.95
6SL7	.89	3E29/	2.95	1613	.95
6SN7GT	.89	304TH	9.85	1616	2.95
6SQ7	.89	307A	6.25	1619	.98
6SR7	.89	446A	2.60	1624	.98
6SS7	.75	6C4	.64	1625	.98
6Q5	.98	705A	4.95	171B	1.95
6Q5G	.98	715B	22.50	2AP1	2.25
6U5	.98	800	2.25	3AP1	3.45
6V6GT	.99	801A	1.75	3BP1	2.95
6Y6G	.89	803	8.95	5BP1	3.95
7C4	1.50	805	3.75	5BP4	5.45
7F7	1.25	807	.95	5CP1	3.95
		808	2.95		
7L7GT	1.39	809	1.50	7BP7	7.95
12AT6	1.10	811	1.95	913	3.00
12SA7GT	.99	812H	6.90	7EP4	23.50

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Pair in Series for 110 v. AC.

Type I—5¼" long, 3" dia.—50 v. AC. 50 cy.—4 lbs.	$ 9.95 pr.
Type II—6¼" long, 4¼" dia.—115 v. AC. 50 cy.—12 lbs.	12.95 pr.
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JOHNSON EDGEWOUND COILS

No. 2263HM4

Just the thing for your antenna tuner. Heavy duty Hi-volt. insul. coil—ruggedly built—handles up to 750 watts R.F.—Turns can be removed to resonate at any amateur bands. Heavy mycalex insulation, air wound. Efficiently made to give lower surface resistance by flat winding, 26 turns spread ¼" apart. Complete with four mounting lugs.......Excellent buy, 2 for **$3.95**

DYNAMOTOR

12 v. dynamotor—ideal for portable 2 meter rig—low battery drain. 235 v. output at 90 mils. Can be run at 50% overload—gives up to 110 mils at 215 v. without damage for continuous duty — complete with filter..........................Special 2 for **$4.95**

Micro Switch—can be used on AC with ratings of 1200 watts up to 600 v. AC also for DC work—normally open-Die Cast—
BZE-2RQ9TN.......................... **$1.25**

Blower 6 v. AC or DC hi speed blower made by John Oster. Rated at 5000 RPM—1.8 AMP—made for continuous duty—1½" overall diameter—1" blower output—¼" blower intake.............. **$5.95**

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83-1R	.45
UG-12/U	.59
83-1T	1.49
83-1AP	.79
UG-28U	1.49
83-1F	.99

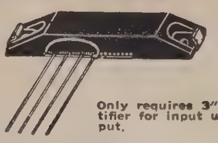
Birnbach No. 1475 feed thru insulator..........$0.29

Rotary Switch—3 deck—9 position non-shortening ceramic wafers. Each.................. **$1.25**

CF27—Filter Condensers—1 MFD 2500V, DC.................................. **$1.19**

R.F. Choke—R154—1MH @ 600 MA with mounting bracket...................... **$1.25**

R.F. Choke—3½ MH @ 150 MA on ceramic with threaded mounting hole.................. **.18**



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$.89 or 5 for **$4.00**

ROTARY ANTENNA DEVICE

Here is the answer to that rotary antenna joint problem for 360°. A compact unit with four slip rings & contacts, silver plated, of course. Can be used for a stacked array—10 & 20, 6 & 10, 2 & 6, etc.... **$1.89**

CARBON THROAT MICROPHONE

This microphone will work into any 200 ohm impedance input circuit. Has adjustable strap to fit any neck. In operation this microphone is strapped around the throat thereby facilitating full freedom of both hands and head movement. Ideal for ultra high frequency mobile work for hams. Supplied with strap, 10" cord and plug.
Your Cost.................................. **.49**

300 ohm twinex—unaffected by moisture—will handle 3 kilowatts of R.F.—losses at 40 MC per 100 ft., are 3/10 DB. Best buy in the house at .08 per foot.

SOCKETS

KS- 3—Amphenol—octal type, ceramic, chassis type elastic stop nuts	$0.12
KS- 5—Isolantite—5 prong, ceramic, large chassis type	.12
KS- 6—Isolantite—6 prong, ceramic, large chassis type	.12
KS- 7—Johnson—4 prong ux base, bayonet, ceramic 25 watt	.75
KS- 8—Hammarlund—S7—isolantite, with hardware	.19
KS-14—Chassis type octal, mica filled bakelite, low loss. 1⅛" mounting with retaining ring	.09
KS-16—Uhf acorn steatite for 6F4, 955 etc. (metal shield with spring—10 cents extra)	.29
KS-17—Johnson—5 prong socket for RK-28, 803 ceramic, bayonet	1.49
KS-20—Johnson—ceramic for 304TH, 304TL	1.00
KS-21—7 prong for RCA 813, mykroy, 2⅝" square	.69
KS-22—Magnal—14 prong scope socket, mica filled low-loss bakelite	1.00
KS-24—Ucinite 829, 832 socket, recessed aluminum case for sub chassis mounting. Socket has built in by-pass condensers for 6 volt tubes	1.75
KS-25—Johnson—7 prong for 829, 832 tubes, ceramic	.29
KS-27—Mykroy socket for VT127/100TS	1.25
KS-28—7 prong miniature with shield	.39

OTHER TYPES IN STOCK—PRICES ON REQUEST

Weston meters — 0-130 V. AC — 25 to 125 cy — #476UM — 3½" $3.95

DO YOU OWN AN SCR-522?

We have a complete power supply, including a separate voltage regulated bias supply chassis and schematic—all in kit form. This kit will supply all voltage necessary for normal operation of the set. All parts guaranteed. Complete at the amazingly low price of........................ **$14.95**

BC-348 Owners

CONVERTER FOR BROADCAST BAND

Convert that BC-348 without any alteration in your circuit. Our special converter takes power from receiver. Just tune your set to 455 kc. and forget it. All tuning is done on a converter panel covering 550 to 1600 kc.—double conversion means High Sensitivity, Excellent Fidelity, and Higher Selectivity — complete basic kit with schematic and full instructions — less chassis dial and tuning knobs.
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Complete—Contains all necessary components for 110 v. 60 cy. conversion of BC-348.
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HS-16 HEADSET

- 8000 ohms Hi-impedance
- Noise proof
- Most sensitive phone built
- May be used as a sound powered intercom.

Light, durable, efficient. Molded neoprene earcups shaped to completely envelop entire ear. Adjustable steel headband extends or retracts. Especially suited to hams, commercial operators, aircraft pilots, recording engineers and many others. Can be used with simple Xtal to make complete radio receiver.
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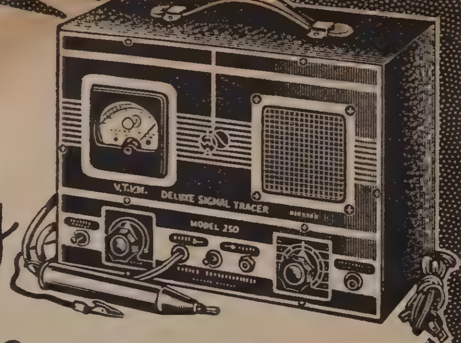

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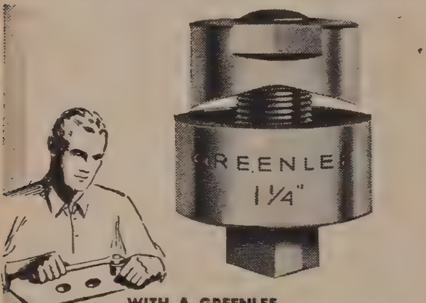

WITH A GREENLEE RADIO CHASSIS PUNCH

- Save hours of work . . . no reaming or tedious filing. Punch cuts through chassis quickly . . . makes accurate, clean holes for sockets, plugs, and other receptacles. Just turn with an ordinary wrench. There's a GREENLEE Punch in each of these sizes: 1/2"; 5/8"; 3/4"; 7/8"; 1"; 1 1/16"; 1 1/8"; 1 5/32"; 1 3/16"; 1 1/4"; 1 3/8"; 1 1/2"; 2 1/4". Write for complete facts. Also get information on Knockout Punches and Cutters for conduit and meter holes up to 3 1/2". Greenlee Tool Co., 1889 Columbia Avenue, Rockford, Illinois.

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Fresh Stock. Fully Guaranteed

		Each	10	100
20 mfd	150V	$0.21	$1.79	$16.95
20-20 mfd	150V	.29	2.49	22.98
8 mfd	450V	.19	1.85	17.98

BY-PASS CONDENSERS

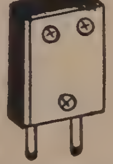
.01	600V	$0.06	$0.55	$ 4.60
.02	600V	.06	.55	4.75
.05	600V	.06	.55	4.95
.1	600V	.07	.65	5.49
.25	600V	.11	.98	8.95
.005	1700V	.14	1.25	9.95
.01	1700V	.15	1.30	10.20
.02	1700V	.16	1.40	10.95

RESISTOR ASSORTMENT

100 assorted 1/4-1/2-1 watt carbon resistors. All RMA color coded. Special $1.29.

CRYSTALS 74c each

Your frequency plus or minus 10 KC



80	Meter, 3500-4000KC
40	Meter, 7000-7300KC for multiplying into
20	Meter, 7300-7425KC
10	Meter, 7300-7425KC
6	Meter, 6250-6750KC
2 1/2	Meter, 8000-8222KC

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put it with my other nine and give me a ten spot for my ten dollars while you're at it." Since he actually does give you nine dollars the first time and another dollar a minute later—ten dollars in all, you can easily see why you can be short changed on this one. Naturally, with the short changer's woman companion keeping up a continuous line of chatter and questioning you without pause in an effort to confuse you and keep your mind off the money transaction, you can understand and sympathize with the retailers who get short changed this way.

The *"important letter"* short change racket is often worked by women. A woman will enter your store and anxiously ask you if you would please give her a ten dollar bill for the ten dollars in change she has in her hand. She shows you a stamped, addressed, special delivery letter and tells you that she has to send the ten dollar bill in the special delivery letter immediately to a son or daughter, who is stranded in a nearby city without funds, or to a sick or injured mother or father, etc.

She always gives you a plausible excuse for wanting the ten dollar bill, and since it will cost you nothing to oblige the woman you will head for your register to get a ten for her. She starts to count her change when you go to your register. She counts it from one pile to another and keeps her hand on the pile she is counting to prevent you from counting the money before she finishes. She finishes her count and calls out, "And ten dollars even!"

You either hand the woman the ten dollar bill or place the bill on the counter for her. Of course you are going to count the change again. While you are counting the change the woman picks up the bill and calls your attention to it when she places the bill in her special delivery letter. After she has made sure that you saw her place the bill in the letter she takes a folded newspaper from under her arm and places it on the counter. She attracts your attention again as she wets the gummed flap of the letter. She then quickly places the letter between the folds of the newspaper and presses across the paper a few times to seal the letter tightly.

She now takes a special delivery letter from the folds of the paper and places it on the counter near you as you continue to count the change. When you finish counting the change you discover a twenty-five or fifty cent shortage. The woman says she is almost sure that she had the correct amount of change and asks for the change so she can count it again.

She quickly counts the change and this time she counts it from the counter to her hand. When she finishes counting she has all the change in her hand and she agrees with you that there is a shortage. Now she acts as though she has just realized that the bill is already sealed in her special

WHAT SERVICEMAN COULDN'T MAKE MORE MONEY THIS WAY?

The business-like way to make money is to keep plugging ahead at your bench. If your stock is lean and you have to run to the distributor every time you need a volume control, you're frittering away your valuable "bench time" and income. Stock up too high on "special" volume controls and you may wind up behind an inventory 8-ball.

HERE'S THE RIGHT ANSWER 9 OUT OF 10 TIMES

The sensible solution to your volume control replacements is the IRC *Century Line*. Over 90% (by actual analysis) of all jobs can be taken care of by these 112 types of volume controls. As a matter of fact, you don't even need the entire 112; a selection of only 70 Type D IRC Volume Controls and 11 Tap-In Shafts may handle most of your work. So see your IRC Distributor right away and save your bench time, patience, and money with IRC.

THE IRC CENTURY LINE

The 112 Volume Controls and 5 Switches That Solve Over 90% of Your Replacement Problems . . . . .

- 70 Universal Type D Controls with 11 easily installed Tap-in Shafts
- 16 Popular Type Controls with Fixed Shafts
- 8 Clutch Type Controls with Fixed Shafts
- 7 Dual Controls with Fixed Shafts
- 9 Controls for Specific Service Used with Fixed Shafts
- 2 Special Controls for Power Requirements with Tap-in Shafts
- 5 Switches

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VOLUME CONTROL
Replacement Manual

Bring yourself up to date with the new No. 4 Edition of this amazingly popular and useful manual. Contains detailed replacement information on nearly all models up to 1946. Complete listing of 1941-42 models . . . the ones now coming in for repair. 156 pages. 25c at your IRC Distributor.

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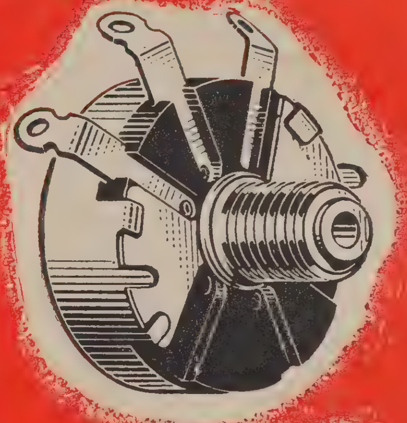
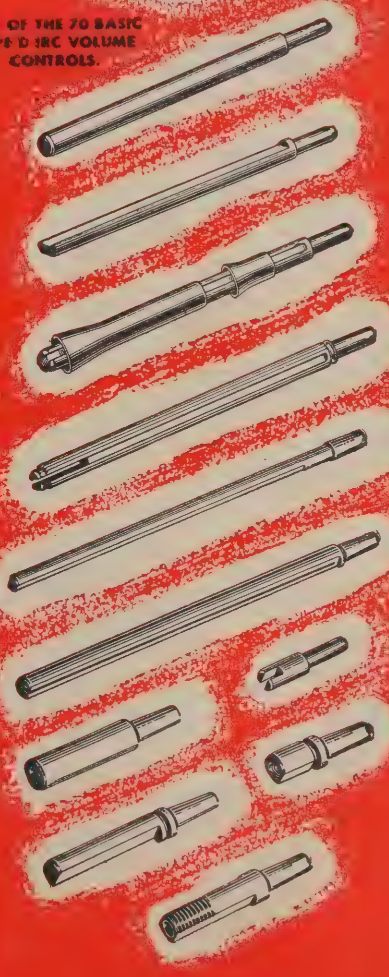


ONE OF THE 70 BASIC TYPE D IRC VOLUME CONTROLS.



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delivery letter and also that she doesn't have another penny change with her.

She says she is so worried about her injured relative or stranded child that she hardly knows what she is doing. The important letter is on the counter near you and she picks it up and says to you, "Must I tear open my letter and get your ten dollar bill out, or would you please put my letter in a safe place for me while I run down the street a few squares to my home and get you the few nickels I'm short?"

Ninety-nine out of a hundred dealers will agree to put the letter in their cash register for safe keeping for the woman while she runs down to her home for the needed change. When the woman leaves she has the ten dollars in change in her hand. And, sad to relate, she will never return for her letter. You may think you are not taking any chances when the woman leaves the letter with you because you actually saw her place the bill in the letter and seal it shut before your eyes and therefore aren't taking any chances, but you will be doomed and disappointed when the woman fails to return for her letter because the letter you have in your register is a duplicate letter that she had concealed in the folds of her paper. When she wet the gummed flap of the first letter and put it in the paper to seal it she switched letters and took the duplicate letter from the next fold of the paper and placed it on the counter for you.

The *"Quarter Switch"* is one of the cheap short change rackets and is worked in the following manner. The short changer always keeps a nickel concealed between his fingers and switches it for one of the quarters that have been given to him as change. He quickly steps away from the change and points at it as he calls your attention to it. He laughingly suggests that a nickel probably got mixed in the quarter compartment of your register, thereby causing the mistake. Since the amount is so small and the customer's explanation a plausible one you usually give the worker of this racket the additional twenty cents. One short changer arrested for working this racket admitted that he had worked it thousands of times on unsuspecting merchants. He had worked it on seventeen merchants the day he was arrested. So, you see a short change racket can be worked on you if you're not on your toes. —30—

NEW TYPE FM TUNER UNIT

THE development of a new and different FM tuner unit has recently been revealed to the trade.

The system from the mixer through the 10.7 mc. i.f. circuit is of conventional design, but the front end assembly features a completely new tuning system. It consists of a modified form of long lines, using an L-C combination in series to cover the 88 to 108 mc. range. The line tuners are semicircular brass rod assemblies with .0005 inch silver overlay, and with the use of temperature compensating condensers, offer relatively negligible initial drift.

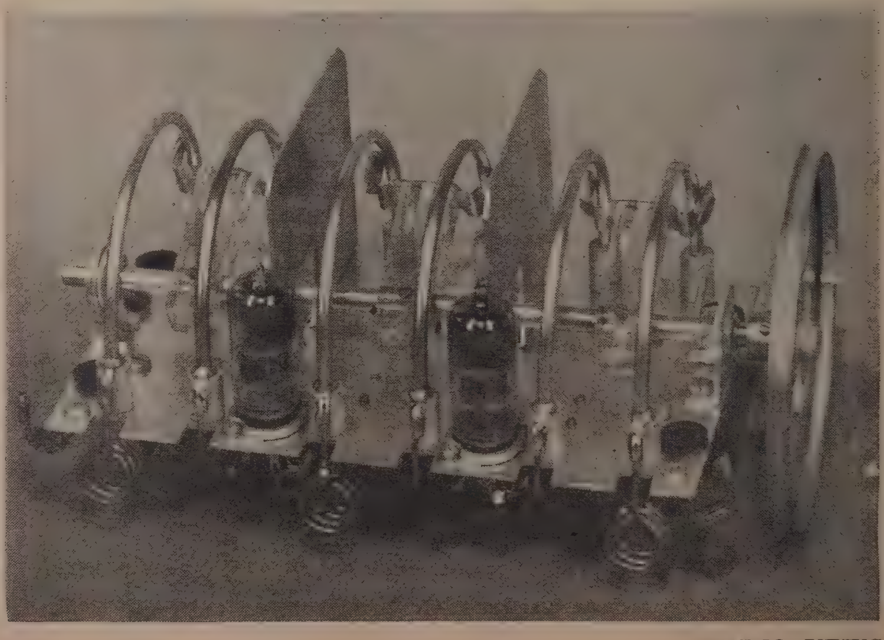
The co-engineers, Mr. Burley and Mr. Cossman of Approved Electronics Instrument Corporation of New York are now planning amateur equipment based on this same principle.

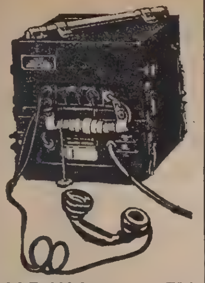
They have already had test setups working on the two-meter band and the 144-148 mc. spectrum was spread over more than 2 inches of the 16 to 1 ratio dial.

Production on the FM tuner started in July.

—30—

Manufacturer claims 200,000 revolutions of the slider without contact trouble.





SCR-610 low power FM trans-rec. Battery operation on 27mc to 38.9 mc. Less crystals......$39.50

HIGH VOLTAGE COMPONENTS

2.6 KVA Amertran Rectifier—output: 0 to 25 KV. at .1A 10% regulation, 2.5% Ripple Input: 208 V, 3 PH., 50 to 60 C.........	
FIL. TRANSFORMER 29,000 V. test. Pri. 115 v. Two Sec. 5 v. at 5 amp. Raytheon..........	$16.50
2 KVA Transformer and choke—115v/50 to 70c input, single phase. Output 17,000v at 144 mils, Amertran. Dimensions: 26x29x 13″....................	74.50
Capacitor—continuous phase shift; effective range 100 cy to 800 kc.......... ..	1.95
Condenser — butterfly, 13 plate, 1½x1½″, ball bearing..................	.95
WE 1-138 Sig. Gen. 2700-2950 mc. CW, provision for pulse modulation, 115-VAC regulated power supply, output meter, attenuator..................	$50.00

HEADSETS

New insert type—comfortable, lightweight, efficient. 500 ohms impedance.......	$0.85
Output trans. to match 500-8000 ohms imp. **.25 extra.**	
Headgear Dynamic mike and headset combination, sound powered. From B-19. Mike and earphones complete................	2.75
Lapp Bowl Type entrance insulator 7″ diam. 4.5″ high, 9/16″ hole..............	1.48

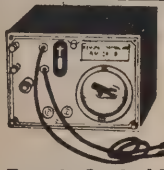
TUNING UNITS

From BC191and 375—contains: coils, chokes, dials, condensers. Range of frequency from 400 KC to 12.5MC. State your approximate frequency. Only:...............$2.75

Ideal Basis For E.C.O. Rig

Tuning units for TCE & GP7 in the following frequencies: A—350 to 800 kcs; B—800 to 1500 kcs; C—1500 to 3000 kcs; E—4525 to 6500 kcs; F—6200 to 9050 kcs. Contains all coils, etc. for these frequencies.

Complete set of five	$11.00
Units C, F. Each...	2.75
Units A, B, E. Each.........................	2.00



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"Communications"

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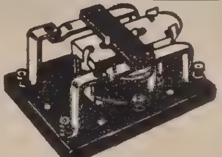

Remote Control Unit RM-29. Ideal for telephone intercommunication over distances up to several miles. Includes ringer.

Two units complete with handsets for 2-way communication.....	$14.00
RM-29, each	5.50
Handsets, each	2.00

OIL CONDENSERS

Sprague, Aerovox, Cornell-Dubilier

15mf 220 vac, 600 vdc CD...	$ 1.75
1 mf 300 vdc.	.20
2 mf 300 vdc.	.25
4 mf 300 vdc.	.30
4 mf 400 vdc.	.50
5-5 mf 400 vdc	1.05
1 mf 500 vdc GE........	.25
2 mf 550 vdc.	.25
.25 mf 600 vdc...............	.20
.85 mf 600 vdc...............	.25
1 mf 600 vdc................	.30
.1-.1 mf 7000 vdc G.E. Pyr...	2.00
In lots of 50..............	1.50
2 mf 600 vdc................	.35
6 sect. ceramic stack **variable** 35-460 mmf 500v.........	1.79
.1 & .5 mf 2000 vdc.........	1.25
10 mf 600 vdc........... ...	.85
5-5 mf 600 vdc Tobe.........	1.00
5-2.5-2.5 mf 600 vdc.........	.75
8-8-4 mf 650 vdc Sprague.....	1.45
7 mf 800 vdc................	.90
3.5-.5 mf 1000 vdc..........	1.00
4-1.5 mf 1000 vdc...........	1.00
.5 mfd 1000 vdc G.E.........	.55
1 mf 1000 vdc...............	.75
.1 mf 1000 vdc...............	.25
2 mf 1000 vdc...............	.89
10 mf 1000 vdc..............	1.40
1 mf 1500 vdc...............	.95
.4 mf 1500 vdc..............	.15
2 mf 660 ac/1000............	.85
.1-.1 mf 2000 vdc...........	1.00
1 mf 2000 vdc...............	1.00
1 mf 3000 vdc...............	3.50
1 mf 7500 vdc...............	12.50
.25 mf 20,000 vdc............	17.50
.1 mfd 6000 vdc G.E.........	1.05
1.5 mf 6000 vdc..............	12.50
4 mf, Solar, 50 WVDC......	.49

Mica

.002 mf 15,000v Sangamo....	20.00
.002 mf 6000v..............	8.50
.005 mf 15000v.............	22.00
.006 mf 10000v.............	17.50

Electrolytics

2 mf 1000 vdc Sprague.......	.50
2 mf 600 vdc CD............	.40
10-10-10 mf 90 vac..........	1.95
200 mfd 250v...............	2.00
4000 mfd 30v CD............	2.50

Dynamotors
For that Emergency Rig

DM-21: In 14VDC 3.3A Out 235VDC 90 ma with filter..	$2.59
DM-25: In 12VDC 2.3A Out 250VDC 50ma............	$2.49
DM-34: In 14VDC 2.8A Out 220VDC 80ma.............	$2.49
DM-42: In 14VDC, Out 515/1030 VDC 215/260ma & 2/8VDC.	$3.95

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GN-45 Plate & fil supply. Output 500VDC 140 ma and 6V 3A. Dim. 8″x8″x6″....................	$4.95
GN-35 2.5 amp at 8V, 100 ma at 325 to 365V; or 1.25 amp at 10V, 70 at 380 to 420V..........	$3.50

MICROWAVE PLUMBING

1.25 CENTIMETER

Wave Guide Section 1″ cover to cover....	$ 2.00
T section choke to cover...............	4.50
Mitred Elbow cover to cover...........	3.00
Mitred Elbow and "S" sections choke to cover........................	3.50
Flexible Section 1″ long choke to choke..	3.00
Tunable Cavity with Coax input and output........................	6.00

3 CENTIMETER

T Sections.............................	$ 5.50
Wave Guide Sections 2.5′ long silver plated with choke flange............	5.75
Wave Guide 90 deg. bend E plane 18″ long.	4.00
Wave Guide 90 deg. bend E plane with 20DB directional coupler............	4.75
Wave Guide 18″ long "S" curve........	2.00
Feedback Dipple Antenna, chock input, (used with parabola).............	4.50
Rotary joint wave guide in/out choke to choke joint.....................	6.00
Rotary Coupler choke input: round guide output.......................	5.25
S curve Wave Guide 8″ long cover to choke Wave Guide 2.5′ long, silver plate, 180 deg. bend choke to cover.......... ..	5.95
Duplexer section using 1B24............	10.00
Wave Guide with slotted section and rotary joint........................	4.00
Wave Guide 5′ length per foot..........	1.50
Pick-up loop with adjustable tuning section, used in duplexer.............	1.50

10 CENTIMETER

Sand Load (Dummy Antenna) wave guide section with cooling fins app 23″ high..	$28.00
Wave Guide to coax with flange, gold plated app. 10″ high.................	17.50
Rigid Coax Directional Coupler CU-90/UP 20 DB drop, has short right angle, about 8″...........................	5.50
Standing Wave Detector rigid coax 58 ohms	5.50
Coax Rotary Joint with mounting plate..	8.00
Antenna in lucite ball for use with parabolic.......................	5.00
Flexible Coaxial Connector, rigid coax to rigid coax ⅜″ diam..................	2.50

SPECIAL

Maguire Wavemeter—No. 1539TFX, 3cm, vernier dial and resonant cavity...$20.00

Relay Miniatures

SPDT 24VDC...............	$ .40
SPST 28VDC...............	.40
DPDT 28VDC...............	.45
SPST 100V overload 380/1800cy..................	.40
SPDT 110VAC 380/1800cy..	.40

Discount on Lots

Telephone Relays

SPDT—with cover..........	1.05
DPST.....................	1.05

Miscellaneous Types

SPDT 5VDC in can with 5 pr. base.....................	.85
DPDT 6VAC Struthers-Dunn	1.45
DPST 6VAC Struthers-Dunn.	1.35
2 Section SPDT 6 VAC Wheelock type...........	1.10
SPDT 115 VAC Leach.......	1.00
SPDT 115 VAC, WE Wheelock type................	$1.25
SPDT 115 VAC, Kurman latch type...............	2.49
SPDT 115VAC GE, with SPST thermal delay section...	1.95
DPDT 24VDC Allied........	.75
DPST Leach antenna relay with SPST rcvr section 24 VDC & 12VDC...........	1.25
4PDT 24VDC GM..........	.85
Solenoid contactor 24VDC Leach..................	1.05
Thermal delay, 45 to 60 sec. Edison type 1503 with 4 prong base..............	2.95

6 VDC Relay Panel

3-DPST; 2-SPST 6 vdc relays mtd on 10″x7″ panel.......	2.75

SPECIALS

RG-9U Coax, GE, silver coated copper, 51 ohm surge impedance. Sold in 100 ft. lengths and 500 ft. reels. Per ft.....................	$0.07½
Rectifier transformer—117VAC input; output 62V at 3.5A. AC. Rectify and use with filter and rheostat to run your 6, 12, and 24VDC equipment.	$1.50
Capacitor—continuous phase shift; effective range 100 cy to 800 kc.	$1.95
Vibrator Transformer—Primary: 6, 12 and 24V; secondaries: (2) 120V @ 175ma. (1) 11V. Dimensions: 3.25″x3″x3″..................	$1.00
Selsyns—Type 5G 115V, 60C AC Dim: 3¼″x5½″. Special: a pair......	$7.75
Toggle sw—4PDT, bat handle.	$0.69
Power Pair—Transformer 470V CT @ 60ma; two 6.3V windings @ 1.65A and two 5V @ 2A—Primary: 115V 50 to 1200 Cy. PLUS a 6 Hy, 50 ma choke. Both..................	$1.99

Tunable Packaged Magnetrons

each with calibrated tuning chart
QK59 2675-2900 mc
QK60 2800-3025 mc
QK61 2975-3200 mc
QK62 3150-3375 mc

Set of 4..................	$160.00
Each.....................	.45.00

Microwave Tubes
MAGNETRONS

3J31 1cm	$17.50
2J26 10cm	25.00
2J32 10cm	25.00
2J38 10cm with magnet.	37.50
WE 700A L Band	35.00
WE 720BY S band	20.00
with magnet............	38.50

KLYSTRONS

2K25/723ab..............	7.75
2C40 Lighthouse tube.....	2.50

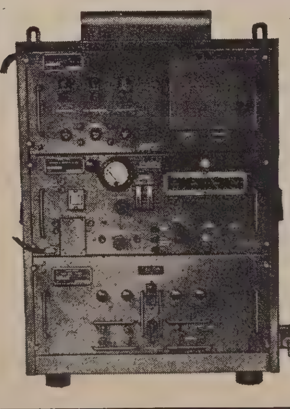
ARC-5 Receiver Accessories

Triple head control box.........	$1.00
Plug-in coil unit .19-.52 mc or .52-1.5 mc ea................	.50
Mounting rack.................	1.00
Double mounting rack.........	1.65
Shock mounts..................	.95

All parts interchangeable with SCR-274-N.

RCA 12 Tube Superhet

100 to 1500KC. 115V operation Dim: 24″x18″x13″. Used: in excellent condition guaranteed.....................$29.95



RC-145 & 148

1KW pulse output on 154 to 186mc. 117 VAC power supply. Can be converted to CW or Voice operation without difficulty and easily lowered to 144-148mc band. 5 stagger tuned receiver IF stages make for ready adaptability to FM or TV. Can be used as a low power Radar set.

RC-145, NEW, complete with instruction book, including selsyn rotary beam direction indicator unit....$200.00

RC-148, consists only of transceiver and power supply. Both units with tubes. Slightly used.........$47.50

TRANSFORMERS

All Primaries 117V 60 cy Secondaries

No. 5084—1000V CT and 880V CT @ 250ma, 6.3V @ 15.A..	$ 6.95
No. 6114—1900 V CT @ .350 MA by using 2 trans. Per. Pr.	10.00
No. 5190—6180V @ 200 ma..............................	14.75
No. 5057—6.3 CT 1A, 5V CT 3A, 5V CT 3A................	2.75
No. 5104—6.3V @ 1A, 6.3V @ 1A, 6.3V @ 1A..............	2.45
No. 5126—5V CT 3A, 5V CT 3A, 5V CT 6A.................	3.25

CHOKES

Amertran—RMS test 15KV, 1 Hy. .8 amp DC, DC resistance 7.5 ohms.........................	$8.95
8.5 Hy. 125ma, 1780 V Test.........................	1.45
Dual: 7Hy. 75ma. 11Hy. 60 ma, 1780V test............	1.95
Dual: 2hy 100 ma each section. Utah..	.90
Filter choke. CTC. 5hy 40 ma.......................	.45

(Conservative Ratings)

PULSE TRANSFORMERS

GE Type K2450A. Will receive 13KV, 4 microsecond pulse on prim-secondary delivers 14 KV, Peak power out 100KW..	$15.00
Hi Volt. Magnetron Input transformer. W.E. No. D-166173 with cooling fins..............................	12.00
Raytheon UX 4298E—Pri. 4 KV, 1 microsecond Sec. 16 KV. 16 Amps. Fil. pri. 115V. 400 Cycle............	15.00
W.E. Hi Volt input pulse Transformer No. D 169271......	9.95
GE Radar pulse Tformer K2731 Diameter App. 11″ vertical cooling fins............................	19.50
Utah Blocking Oscillator transformer, 3 windings, No. 9280 or 9318...............................ea.	.75
Pulse Input line to magnetron GE K2748A.............	12.00

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D167332 bead............	$0.95
D170396 bead..	.95
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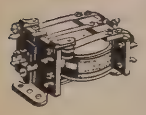

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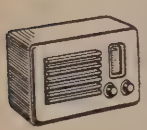

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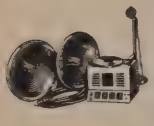

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Broadcasting from Planes

(*Continued from page 67*)

of inaccessibility to any portion of the crankshaft for power transmission.

In large planes it is possible to install a complete gasoline driven generating plant. This requires careful precautions against fire hazards.

Wind driven generators, if procurable, are an excellent solution. Propeller-driven d.c. generators can be used to keep the batteries up to full charge where a storage battery converter has been installed. If the owner can obtain a 60-cycle wind-driven generator with a 110 volt a.c. output, any conventional amplifier could be used. Wind-driven generators of 400 cycles have been built for aircraft electrical requirements. These are lighter in weight than the 60 cycle models, and would be most suitable, especially where the amplifier is designed for 400 cycle supply. For 100 audio watts to operate a 100-watt loudspeaker, the generator should have a capacity of 300-500 watts. Where 200 to 300 audio watts are required the generator should have a capacity of 750 watts.

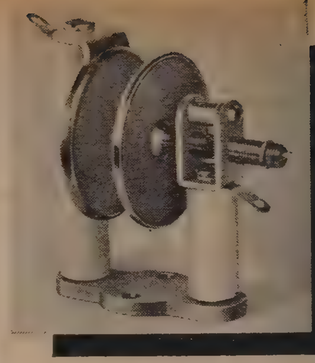
Amplifier

As pointed out elsewhere, weight can be saved where the amplifier is custom-built to the precise requirements of the installation. Assuming a carbon microphone of the close talking type is to be employed, the amplifier need have no more than 70-80 db. gain. This is easily obtained in a 3-stage amplifier. It is recommended that the output stage be designed around a pair of 811 tubes operating in push-pull "Class B." This will afford power output in the neighborhood of 150-200 audio watts when using a plate supply of 1500 volts. The generator delivering the high voltage for the plate supply should, of course, be capable of meeting the peak current requirements.

Of course, high-powered amplifiers can also be designed to operate around a group of 6L6 tubes with a plate voltage of 400-450 volts. This lower plate voltage may be found more desirable because of the availability of genemotors delivering this output. The output stage should consist of six 6L6's arranged in push-pull multiparallel. This should be designed for "Class AB" conditions and will deliver close to 100 watts.

Loudspeaker Installation

Since loudspeakers of the order of 100 watts or more are designed to utilize a group of individual driver units mounted on a common mixing chamber and air column, a great deal of flexibility in wiring is available. This makes it possible to utilize a group of medium-powered amplifiers. For instance, the *University* Model 4A4, 100-watt loudspeaker contains



new **NZ-10**
NEUTRALIZING CONDENSER

The improved design of the NZ-10 features smooth micrometer capacity adjustment and positive locking. Suitable for either single ended or push pull stages the NZ-10 has particular application in high frequency circuits where very fine capacity adjustment is required.

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SURPLUS SAVERS

TRANSFORMERS—115v, 60 cycle; 430-O-430-510 mils; 5.2v at 6 amps. NEW; grey case, Acme porc. terminals $6.75
350-O-350—250 mils; 5.0v C.T. at 3 amp.; New; cased Langevin... $3.50
AUTO TRANSFORMER — Acme—220-110 (6 taps) step-up or step-down. 500-watt. New $9.95
25-watt SIGNAL CORPS TRUMPETS complete with driver unit and UTC output transformer, tapped at 250-500-1000-2500 ohms. New. Each.... $20.
Also
packed in lots of 4 in H.D. trunk for portable. Complete 4 in trunk. New .... $65.
I.R.C. wire-wound RHEOSTAT 100-watt 1.1 ohm; off-on toggle switch, mtd. on control shaft. Excellent for filament control, etc. New with knob.......... $1.75
UTC Band Pass FILTER passband; 500-2000 cycles. Useful as filter in peak clipper circuit. Second method of connection bandpass of 900-1200 cycles; use for Audio selectivity in CW reception. New, with hookups $1.25
Control box for Collins transmitter. Contains plug & 7 deck SP, 10 pos. sw. and SPDT rotary sw. New. Each $0.75
Control box for 2A gear. Contains switches, plugs, pilot lamp, etc. Each $1.00

25% deposit required on all C.O.D. orders. Prompt delivery assured. Write Dept. RNS.

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OUR SPECIAL PRICE ONLY	$65.00

YOU SAVE $64.80.

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Superior PB-100 Volt-OHM-Milliammeter	27.50
Monitor Crystaliner, regular price	57.50
Simpson 305 Tube Tester	48.50
Total Value	$173.40
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YOU SAVE $88.40.

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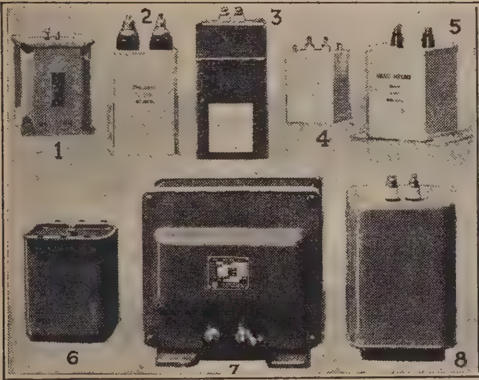
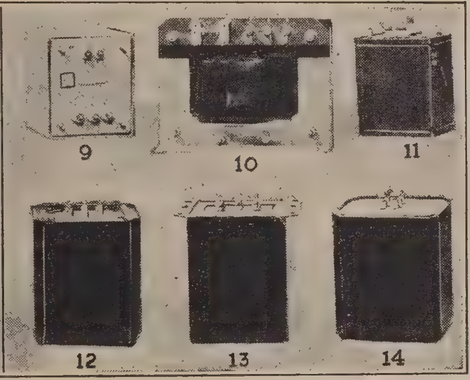
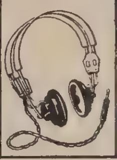
Other used Test Equipment combinations at comparable savings are generally available. Write for complete details or use the handy coupon below. And if you're interested in trading new for old, our complete stocks and bigger-than-ever trade-in allowances on your used equipment are sure to please expert and apprentice alike.





ARMY SURPLUS HEADPHONES



Type HS-23. 8000 ohms impedance. Adjustable leather headband. Rubber cushions. Brand new. In original box.............. **$1.29**
When ordering, add 20c to cover cost of postage and insurance.

Throat Mikes. 200 Ohm carbon.......... **35c**

WHEN ORDERING, ADD 17c TO COVER COST OF POSTAGE AND INSURANCE.

PE-103 Generator. Brand new Dynamotor Power Supply. Operates from 6 or 12 volt. Delivers 500 volts D.C. at 160 M.A....... **$9.95**

Amphenol All-Wave Antenna. Provides interference-free reception on FM Standard Broadcast and Short Wave Bands. No. 124-001............................ **$17.49**

Selsyn Motors. 115 VAC 60 CY. Navy Surplus Selsyn Motors, large, continuous duty type.
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No. 6813. A super buy at........ **$17.95**

(8) **FILTER CHOKE.** 8 Hy. at 500 MA. 55 Ohms DC res. Very high quality. Hermetically sealed. No.8056. Net **$11.85**

(9) **PLATE TRANSFORMER.** 2500 VCT., 150 MA. Pri. 115 VAC: 60 CY. Steel case with standoff insulators.
No. 161919........................ **$9.95**

(10) **RCA 1 KW MODULATION TRANSFORMER.** Primary will match class "B" tubes up to 10000 ohms plate to plate. Secondary No. 1, 450 MA for beam tube plate. Secondary No. 2, 80 MA for screen grid........................ **$14.95**

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No. 8275........................ **$9.95**

(13) **PLATE TRANSFORMER.** 1400/1200 VCT at 200 MA. Pri. 115 VAC 60 Cy. Steel Case, screw terminals.
No. 4891-N........................ **$7.45**

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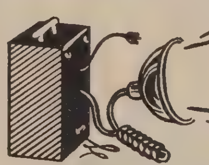

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3. Synchronizer adjustment control.
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5. Unit can be fired every 3 seconds if necessary.
6. Neon bulb charge indicator.
7. 1/10,000 Second exposure.
8. Triggered by hand switch or synchronizer.
9. Sockets for connecting all cables.

Complete Kit including AMGLOW tube, carrying case, etc. with simple assembly and operating instructions.
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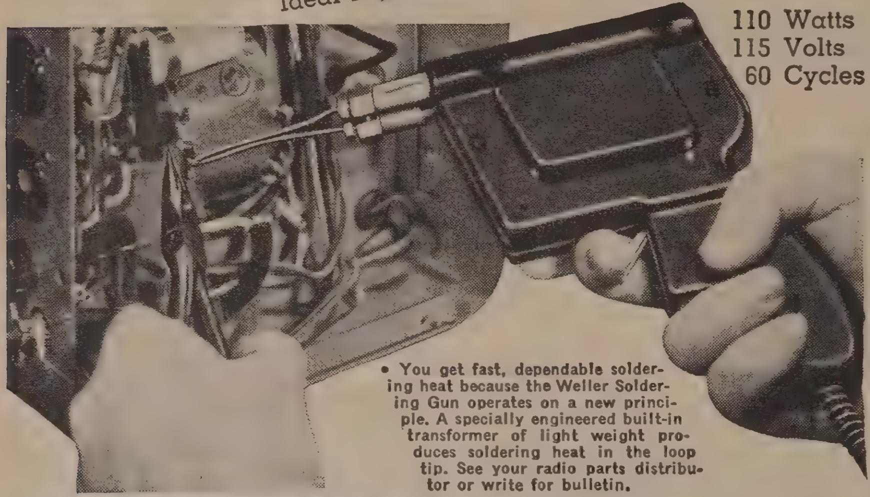

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four driver units, each rated at 25 watts. They can thus be wired to four amplifiers each with 25 watts output power, or connected so as to be fed from two amplifiers of 50 watts output each.

The *University* Model B-6 loudspeaker rated at 150 watts contains six individual driver units inside the housing. The Model B-12 loudspeaker rated at 300 watts contains 12 driver units, each of 25 watts capacity. Thus, a number of output stages or boosters of, say, 50 watts each can be used and these are commercially available from a number of amplifier manufacturers. This type of installation, namely the utilization of several power output stages, affords a great deal of safety factor since if one of the power stages should fail, there remains sufficient power to keep the equipment operating without complete interruption of the service.

Installation in the Piper Cub

When the installation is to be temporary, the door of the plane should be removed and the loudspeaker mounted at such an angle that the sound can be projected downward and somewhat to the rear. The mouth of the horn should project six inches to 1 foot outside of the cabin.

For a more permanent installation in a Cub, the rear seat and the rear floorboard should be removed and a hole corresponding to the diameter of the loudspeaker should be cut into the fabric at this point on the bottom of the fuselage, just back of the rear control stick. The loudspeaker should be securely braced inside the cabin, standing directly over the opening of the fuselage. This type of installation offers no parasitic drag to the aircraft but may cause acoustic feedback. The edges of the hole in the fabric must be properly protected against possible wind damage and must conform with CAA requirements. A wire mesh screen should be used across the hole, held down with two plywood escutcheons or large washers, one inside and one outside which would reinforce the fabric edges.

In other models of ships it is possible to locate the loudspeaker under the fuselage between the wheel struts. This is an excellent location. In all cases the airplane must have adequate pay load for the weight of the sound equipment and this equipment must be so located in the plane that it does not upset its center of gravity, especially laterally. For a longitudinal displacement of the center of gravity, the trim tab or stabilizer can, of course, be adjusted for correction.

The removal of the door, the opening of the fabric, and the installation of heavy equipment may involve special permission from the Civil Aeronautics Authority. Whenever changes in the plane structure or serious redistribution of weight results, the CAA should be notified. Generally such permission, with special restrictions, is given but in many cases the

NC license is replaced by a NR or "restricted" one.

A complete high-powered sound system for reliable high altitude operation would weigh almost 300 pounds. This is proportioned as follows: Loudspeaker (100 watts)—60 pounds; Amplifier—75 pounds; Storage Batteries and Converter—150 pounds; a total of 285 pounds. —30—

CITIZENS' BAND OPENING NEARS

THE day when individuals will be able to use small radio receiver-transmitters for private purposes moved a step nearer reality today when the Federal Communications Commission proposed technical requirements and procedure for obtaining type approval of equipment to be used in this contemplated new service.

In its frequency allocations report of May 25, 1945, the Commission set apart the band of 460-470 mc. for this purpose. Subsequently, and in cooperation with manufacturers and others interested, the Commission's engineering staff worked out technical standards for the equipment to be employed. Every effort has been made to keep these requirements to a minimum consistent with the need for apparatus that is reasonably low in price and whose operation will not require technical skill, yet will permit the widest possible use with the least amount of interference to other radio operations.

Pending the establishment of the Citizens' Radio Service, no licenses are being issued to the general public except on an experimental basis. However, as soon as approved equipment is available for operation in the assigned band and when the Commission has drafted rules and regulations governing such use, the public will be notified that the new service is here and that applications from interested individuals will be received.

(Editor's Note: The FCC technical report as it stands now definitely indicates that only commercially built equipment can be used for operation in the Citizens' Band.)

As in the case with all types of radio operation, authorization will be necessary. In the case of the Citizens' Radio Service, the Commission contemplates a simple procedure requiring no technical knowledge by the prospective user.

It should be pointed out that war surplus "walkie-talkies" will not operate in the band designated for citizen's use. This military equipment was designed for particular frequencies which could be used overseas but which, if employed in this country, would interfere with marine, police, fire, and other radio services. It is impracticable to convert this apparatus, since an uneconomic degree of rebuilding would be involved.

Due to these and other considerations, it is illegal for the unauthorized individual to attempt to use surplus radio transmitting equipment. Under the Communications Act, no person may operate a radio transmitter without first obtaining a license from the Commission. Violators are subject to possible fine or imprisonment, or both. And the Commission's monitoring stations are quick to detect unlawful transmission! —30—

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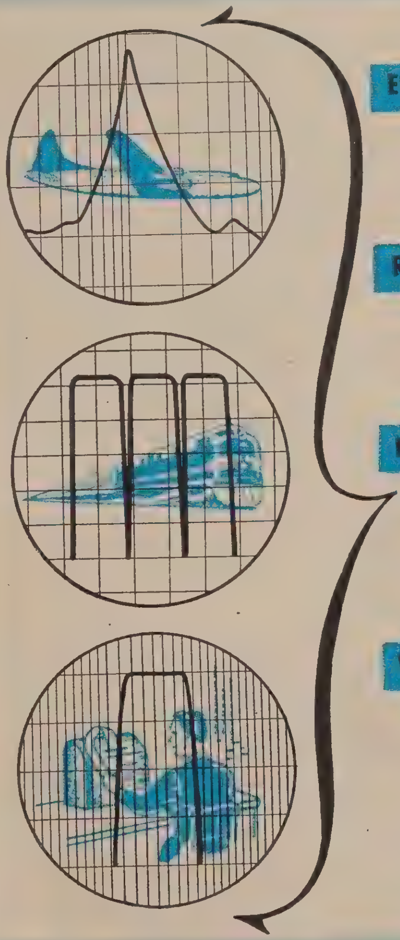
Our toroid filters have become a by-word in every phase of electronics where only the best results are acceptable. Toroidal coils wound on MOLYBDENUM PERMALLOY DUST CORES are the primary basis for our success in producing filters unexcelled in performance.



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For the EXPERIMENTER

WIRELESS MICROPHONE

Microphones which may be connected to the family radio have long been a popular item with the experimenter. At parties they often serve as a means of entertainment.

Unfortunately, connection of these microphones often involves considerable work, the problem varying widely with different types of receivers. In many cases it is necessary to have a circuit diagram of the receiver, and changes of the wiring are required.

For several years, wireless record players have been used, permitting the playing of records through any standard radio, with no physical connections between the record player and radio. This permits the record player to be placed in any convenient spot, and the radio tuned to its carrier frequency.

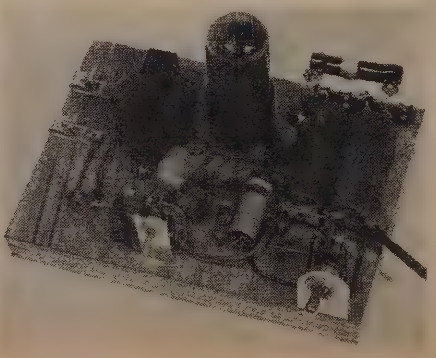
By a few simple changes in the circuit of the conventional record player, this type of instrument may be used as a wireless microphone, in the same manner as a record player. In general the only additional equipment needed is a microphone transformer and microphone. If it is desired to leave the record player undisturbed the best procedure is the construction of a separate unit for wireless microphone use.

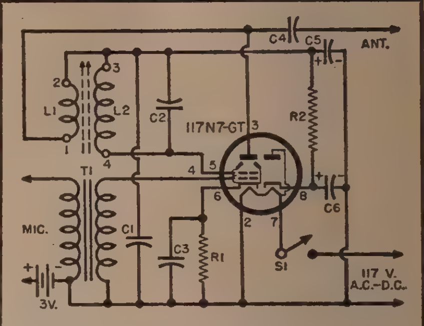
The unit shown in Fig. 1 has a frequency range of 1250 to 1620 kc. Only one tube, a combination beam power output tube and half wave rectifier, is used. The unit may be used on any standard 117 volt line, either a.c. or d.c.

Breadboard construction was adopted using a piece of 5 x 7 inch plywood to mount all parts. The microphone transformer is mounted at the left side of the breadboard close to the tube socket.

Short lengths of tubing are used to mount the tube socket by means of long wood screws. The filter condensers and filter resistor are mounted at the right by means of tie lugs. Brackets formed from scrap aluminum are used to support the oscillator coil and on-off switch.

Fig. 1.





C_1—.002 μfd., 500 v. mica cond.
C_2—.00035 μfd., 500 v. mica cond.
C_3—.01 μfd., 400 v. paper cond.
C_4—50 μμfd., 500 v. mica cond.
C_5, C_6—40 μfd., 150 v. elec. cond.
R_1—500 ohm, 1 w. res.
R_2—2000 ohm, 10 w. res.
L_1, L_2—Adjustable iron core osc. coil (Meissner No. 14-1028)
T_1—Single button microphone-to-grid trans.
S_1—S.p.s.t. toggle sw.

Fig. 2.

A standard replacement type adjustable iron core oscillator coil is used. A fixed condenser is mounted across the secondary terminals of the coil and adjustment of the oscillator frequency is accomplished by screwing the iron core in and out of the coil. As the core is inserted farther into the coil the frequency of the oscillator is lowered.

The circuit used is essentially a Colpitts oscillator with the screen grid and plate of the tube being used as a triode. The control grid is used for injection of the modulating voltage. By using this system of modulation it is possible to obtain a relatively high modulation percentage and still retain frequency stability.

The r.f. output from the oscillator is coupled through a small condenser to the antenna terminal. The length of antenna needed will depend upon the distance from the receiver and the sensitivity of the receiver. No longer antenna should be used than needed, to prevent interference with neighboring receivers. Generally one or two feet of wire will suffice.

Microphone current is obtained from two flashlight cells. The microphone used is a surplus military type.

When construction has been completed, the unit should be plugged in, the switch closed and the tube allowed to reach operating temperature. The unit should be located near a broadcast receiver, tuned to a clear spot near the high frequency end of the broadcast band. The iron core should

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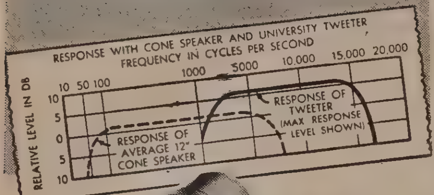

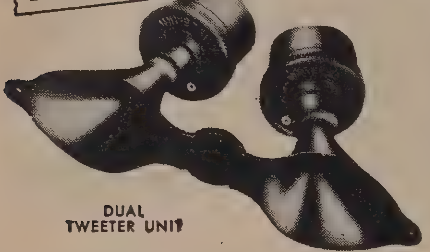

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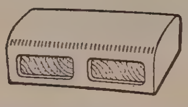

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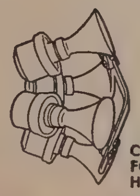
SINGLE UNIT TWEETER ONLY 2¾" DIAMETER



CLUSTERED TWEETERS FOR WIDE VERTICAL AND HORIZONTAL DISPERSION

University Loudspeakers

then be adjusted until the carrier is heard in the receiver.

The microphone and batteries may now be connected and the unit is ready for operation.

BYPASSING

The term "bypass" is frequently used in radio and electronic literature, and is applied primarily to condensers. A dictionary definition of a bypass condenser is "a condenser connected to provide a low-impedance path for radio-frequency or audio-frequency currents around a circuit element."

All of us are probably more familiar with screen and cathode bypassing than with other types and so a brief word on this subject may be helpful in designing new equipment or in understanding the functions of the various components in equipment already designed.

In this case, the circuit element being bypassed is either the screen or cathode resistor. In most applications, the screen and cathode voltages should be held constant, and so some means must be provided for preventing the variable components of plate or screen current from flowing through these resistors. This is done by providing a low impedance path around these resistors, through which the variable components of current flow.

The term *low impedance* is relative, that is, the actual value of impedance which can be termed *low* depends on the value of resistance or impedance being bypassed. For most practical applications, the impedance may be considered sufficiently low if it is one-tenth or less of the component being bypassed.

We must also consider the operating frequencies in the circuit. Since the reactance of a condenser increases as the frequency decreases, we must choose a condenser which has sufficiently low reactance at the *lowest* frequency which we wish to amplify. This is true both for audio frequencies and radio frequencies. Thus, for proper bypassing, a condenser must be chosen which has a reactance of one-tenth or less of the circuit element being bypassed *at the lowest operating frequency.*

One or two examples may serve to clarify the above explanation. Suppose an audio frequency amplifier stage is being designed which is to amplify down to 50 cycles, and which has a cathode bias resistor of 1000 ohms. We must then choose a cathode bypass condenser having a reactance of 100 ohms or less (one-tenth of 1000 ohms) at a frequency of 50 cycles. The reactance of a condenser is given by the following equation:

$$X_C = \frac{1}{2\pi f C}$$

Where X_C is in ohms, f in cycles, and C in farads. Solving for C gives:

$$C = \frac{1}{2\pi f X_C}$$

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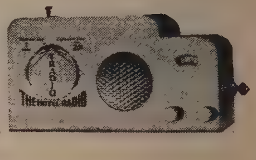

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Volt—Ohm—Milliammeter

A dependable instrument of wide utility—sensitivity 1000 ohms per volt.
Ranges: Volts AC, DC, and Output Ranges,
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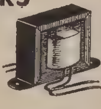

Clean stocks — long leads — mounting feet — made to fit where you need them.
For 6F6-6K6—to 4 ohm voice coil —size 2" x 1⅝" x 1⅜".
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Specify quantity of each type you need at...................... 49c

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Standard types—Set Manufacturers close-out —all Guaranteed

Webster F2—Replaces L26-L40-L70 etc.—pin type terminals—1 oz. pressure—1 volt output—5000 cycle cutoff.
List price $5.00—you pay us..... 1^{49}

SHURE P93—W57A—pin type terminals—¾ oz. pressure—1.6 volt output—6000 cycle cut off.
List price $4.45—our Special..... 1^{98}

Astatic L-70—new postwar design —solder terminals—1¼ oz. pressure —1 volt output—4000 cycle cutoff.
List price $5.55—we quote you.. 1^{98}

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Selenium cell only, no holder, postpaid... 1^{80}
(Puts new life into Philco Changers)
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Underwriters Approved brown rubber covered insulated parallel Cord—"zips" apart easily—non fraying—deluxe—way above average quality.
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Stranded No. 22 tinned wire—glass "ROCKBESTOS" 1000 volt insulation—fireproof aircraft wire—a wartime development—at this low price you can use the best—

100 feet......... 45c **1000 feet**. ....3^{89}

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- Candelabra screw base for 110 volt lamp.
- Mount in 1" hole.
- Lamps removable from front of panel.
- Available marked 1-2-3 or 4 on back of white lens.

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LEEDS The house you have known for 25 years

Radio Transmitter & Receiver APS 13

410-420 mc., light weight, fully enclosed; 30 mc., I.F. Complete with 17 tubes, including 5-6J6; 9/6AG5; 2/2D21, 1/VR105. SCHEMATIC supplied with each unit. Only .. **$11.95**

Wire wound general radio type Potentiometer, precision made laboratory 25 watt 100,000 ohms; 6″ diam. Brand new..............$1.95

300 ohm Twin Lead, indoor or outdoor cable, per 100 ft..........................$2.95
52 ohm Coaxial Cable RG/8U; outdoor; per 100 ft..............................$4.50

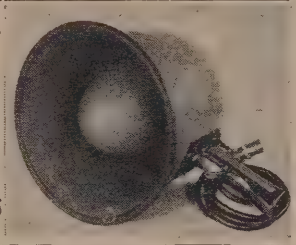
0-1 MA 3″ D.C. G.E. meter..............$3.50
0-1 AMP 2″ R.F. G.E. meter.............. 2.45
500-0-500 microamps 4″ W.E. 3.75

OIL FILLED CONDENSERS

2	Mfd	1000 VDC	$ .79	16	Mfd W.E.	400 VDC	$.98
8	Mfd	1500 VDC	3.25	3x0.2	Mfd W.E.	4000 VDC	.98
2	Mfd	2000 VDC	1.75	2x0.1	Mfd W.E.	600 VDC	.25
0.1	Mfd	7500 VDC	1.50	2	Mfd W.E.	600 VDC	.49
2	Mfd	10000 VDC	17.50	10	Mfd W.E.	1500 VDC	3.50
.02	Mfd	8000 VDC	.98	7	Mfd W.E.	330 VAC	1.25

Loudspeaker LS-6-C

Consists of P.M. Speaker, Microphone, Trumpet, with triggered gun grip handle and connecting cable. Brand New... **$3.95**



Ohmite 50 watt adj. 25 ῼ Resistor........$0.15
10 for.......................... 1.25
Ohmite Rheostats 50 Watt 25 ohm........ .39
25 Watt 15 ohm........ .25

Sigma Relay 2000 ῼ plug in type 4MA DC $0.95
R.F. Oscillator 68-74 MC. with 1G66T Tube .... .50
Bussman 8 AG 1/100 AMP Instrument Fuses, per doz. .... .50

NEONS—While they last.
2 Watt Edison base $0.29
¼ Watt Screw or Bay ...... .20
½ Watt Bay or wire leads.... .08

CONTROL BOX FOR 522 Transceiver—consists of 5 push button switches, 5 WE pilot light assemblies & lever switch, all mounted in metal box. Brand new $1.25

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Free and Rate Gyro. Operates from 24 V.D.C. Special.................**$5.00**

BC-645 TRANSCEIVER; 420-450 MC; complete with 15 tubes including W.E. 316A doorknob and conversion diagram. Brand new in original packing. Special..........................**$14.95**

NEW STOCK OF AMERTRAN TRANSFORMERS, POWER TRANSFORMERS

K-606; 117V 60 cy., 700 V.C.T. 120 MADC; 5V @ 4A; 6.3V @ 4.7A $5.46
K-602; 117V 60 cy., 580 V.C.T. 50 MADC; 5V @ 3A; 6.3V @ 2.A.......... 3.54
K-604; 117V 60 cy. 700 V.C.T. 70 MADC; 5V @ 3A; 6.3V @ 2.5A 4.08

FILAMENT TRANSFORMERS

K-416; 117V 60 cy., 10 V.C.T. @ 8A 7500V Test $3.84
K-404; 117V 60 cy., 2.5 V.C.T. @ 10A, 7500V test 3.24

OUTPUT TRANSFORMER

K-292; for PP 6L6, AB1 PRI-6600 ῼ Sec. 4/8/15/250/500 ῼ 30 watts......$6.54

If not rated 25% with order, balance C.O.D. All prices F.O.B. our warehouse New York. No order under $2.00 We ship to any part of the globe

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Substituting the above values in this equation gives:

$$C = \frac{1}{2\pi \times 50 \times 100} = 31.8 \times 10^{-6} \text{ farads}$$

or 31.8 μfd. A 40 or 50 μfd. electrolytic condenser would thus be the logical choice.

Let us consider a screen bypass condenser for an audio amplifier. Assume a screen resistor of 10,000 ohms and a low frequency of 50 cycles. Using the above equation gives a value of 3.18 μfd. Here the logical choice would be an 8 μfd. electrolytic unit.

For radio-frequency bypassing, the bypass condenser is usually much larger than would be indicated by the above line of reasoning, because the additional safety factor of the larger condenser means little if any increase in cost. —30—

International Short-Wave

(*Continued from page* 72)

tion verifies by airmail postcard from Radio SEAC, G.P.O., Colombo, Ceylon.)

Broadcast time allocated to each request program is in direct proportion to the volume of requests of each kind received. At present, in a week, there are 55 hours of popular music, 16 hours of classical, and 7 hours of swing and jazz. These figures represent the proportions of requests.

There are no full-time announcers at *Radio SEAC*. All of the twenty or thirty voices heard over the microphone belong to people who do other work in scripting, producing, play adaptation, program compiling, and so on.

In connection with radio broadcasting in Ceylon, we might mention that there is another (separate) outlet in Colombo, with the call of ZOH, "The Ceylon Broadcasting Station," operating on 4.900 megacycles. According to URDXC, current schedule is 0450-1145, with news in *English* at 0900, 1000, 1100. While this station is listed with only 7½ kw. and is intended only for local coverage, I have had reports that it is often picked up with fair signal in Britain and on the Continent.

About Ceylon

Ceylon has been a Crown Colony of Great Britain since 1802, and is an island located off the southern tip of India in the Indian Ocean, with 25,332 square miles of area, and a population (1931) of 5,312,548. The island belonged to the Dutch for 140 years, but when in 1796 Holland had to take sides with Napoleon, Great Britain took Ceylon away from them and kept possession.

* * *

This Month's Schedules

Albania—ZAA, 7.852, Tirana, heard well in New Zealand with news at 1515. (Cushen)

Algiers—Algiers, 11.835, is heard

Iron Repair Kit

IRON REPAIR KIT

Contains a complete assortment of terminals, pins, porcelain insulators, mica, etc., that will fit most flat irons and appliances. Practically every part necessary in the ordinary repairing of flat irons in one handy kit. Additional supplies obtainable so that your kit can be replenished.

Entire kit sent postpaid for only $3.10, plus 18c postage

Electrical Appliance Repair Parts

Lead wire. Asbestos covered heater hook-up wire. 10 ft. $1.00
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Heating element wire. 10 ft. coiled 3/16″ O.D. #22 .... 1.77
Ribbon element heating wire. Std. size 100 ft.. .75
Christy Electric Heating Element Welding FLUX for repairing flat irons, toasters, electric stoves, etc. Enough for 50 elements....... 1.00
Hot plate bricks, 5¾″ diameter. 6 for....... 1.62
Element cement. Withstands 3000° F. 1 lb. package.............................. 1.00
Carbon brush set. Assorted. 104 brushes. 15 Springs. Complete 3.00

REPAIR ELEMENTS FOR ELECTRICAL APPLIANCES

Renuall Iron element. Guar. 1 year. Package of 6...........................$3.12
Irons. Porcelain shoes for 500-600 watt. Set of 4.............................. 1.00
Percolator element. Universal flat type. 1 Yr. guar. 2 for........................... 1.20
Percolator element. Porcelain for new glass types. 2 for........................... 1.80

HOW TO FIX IT BOOKS

Armature and Magnet Winding. 270 Pages....$1.50
Practical Electricity and House Wiring. 200 Pages. 277 Illustrations.................. 1.50
Modern Electric and Gas Refrigeration. 928 Pages. 408 Illustrations................... 5.00
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Watch & Clockmakers Handbook. 551 Pages. 464 Illustrations 6.00
Here is your opportunity to save on repairing your own appliances and to earn extra money repairing appliances for friends and neighbors.

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TRANSVISION'S NEW 12″ TUBE KIT

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GIVES YOU *LARGER* IMAGE THAN SETS SELLING AT $500

Here is a television receiver with a 7½″x10″ screen—easy to assemble in about 20 working hours. Designed and constructed by Transvision engineers with the same technical skill which goes into their 7″ kit.

Just tally some of these features:

1. 12″ magnetic type picture tube.
2. Receives all television channels on the air with provision for factory to add new channels as they open at NO EXTRA COST!
3. 4 mc band width for full picture definition.
4. 9,000 volts second anode potential for brightness and contrast.
5. Ratio detector for sound gives highest quality FM reproduction.
6. 22 tubes and picture tube.
7. Complete with antenna, tubes, pre-assembled and tuned R.F. Unit.

Kit comes with simple step-by-step assembly instructions. Factory guarantees clear, sharp reproduction comparable to sets selling at twice the price.

Here's a value you can't beat! Order now and be one of the first to have one of these beautiful, new Transvision sets. A $25 deposit will assure you early delivery. Beautifully turned walnut cabinet available at slight additional cost.

7″ tube Transvision kit still available at $159.50.

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Distributors for Transvision Television Kits
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DEALERS: We invite your inquiry regarding an attractive money-making deal we are prepared to make with live-wire radio men!

with fair signal on West Coast at 0130 with French. (Nankervis) Heard in Britain signing *on* with "Ici Radio Algiers" at 0630; has Arabic programs to 0900, then French to sign-off at 0915. (Pearce)

Anglo-Egyptian Sudan—Radio Omdurman, 13.320, recently following its Friday *(English)* news, 1230-1245, was heard acknowledging reception reports, said replies are sent in writing (probably means via letter-verie); had topical talk until close of *English* period at 1300. (Pearce) A 31-m. outlet of about 9.650 is scheduled in dual.

Angola—A station heard in Portuguese, irregularly afternoons, on 15.895, has been identified as CR6RL, Radio Clube de Angola, in Luanda. When first picked up in Pennsylvania by Kary, time was 1540-1600 sign-off with Portuguese National Anthem. (Kary, Legge) Has been heard in South Africa; calls announced were CR6RL, CR6RA, CR6RN; schedule appears to be 0100-0215, 0630-0745, also heard *before* 1200 and *after* 1500. (Laubscher) The 15.895 outlet has been heard in Sweden weekdays around 1330-1600, Sundays *to* 1300. (Skoog) Heard in Britain from 1300, playing Spanish, French, *English* recordings. (Harrison)

Argentina—Radio Splendid, 11.971, Buenos Aires, has fine signal in West Virginia after Brazzaville's 11.97 closes down around 2000. (Arthur)

Australia—VLC4, 15.32, has replaced VLC9, 17.84, to Asia and Britain, 0830-1045. (Balbi) VLC4 has replaced VLC11, 15.21, to British Isles, 1245-1415. (Pearce)

During the summer *Radio Australia* has been using VLC, 15.200, 50 kw., to Eastern North America, evenings, 1900-2015, with news at 1930; VLA10, 100 kw., has been in dual, beamed to South America on 17.840, but by this time will have likely moved to 17.800 for this beam, having been usually inaudible on 17.840 due to QRM from Moscow (announcing 17.82 or 17.83 but actually operating on about 17.839).

In the Forces' beam, 0330-0645, VLB8, 21.60, has been replaced by VLB10, 11.74. (Radio Australia)

Belgian Congo—Leopoldville's 9.745 is used 1530-1645 or later in the British Isles-Europe beam, instead of 17.770; news at beginning; good signal here in the East.

Brazil—PRE-9, Fortaleza, scheduled 6.105, 0900-1200, 1600-1900; 15.165, 1900-2030. ZYB-7, 11.765, Sao Paulo, is heard with fair signal around 1930; severe QRM from KCBR at times; announces "Radiodifusora Sao Paulo, Emissora Sociedas de Sao Paulo, Brasil." (Kary) PSH, 10.22, PSL, 7.94, heard in dual 1700-1800. (Beck)

British Honduras—ZIK-2, 10.598, Belize, heard in West Virginia signing *on* at 1332; fair level. (Arthur) Runs to around 1400.

British Somaliland—Radio Somali, 7.125, verified by letter from Department of Public Relations, Hargeisa, British Somaliland; power given as 1 kw.; now using single wire antenna; heard in New Zealand to after 1000. (Cushen) Call is VQ6MI, scheduled 0730-1000. (Radio Australia via Arthur)

Burma—Rangoon now verifies by card; latest schedule is reported 2015-2030, 0115-0130 on 6.035; 0840-1015 (in *English*) on 9.540, news at 0845, 1010. (NZDXC) *(If you do not find this station on 9.540 at the time indicated above, try 6.035, as frequency in use for the English session—0845-1010—appears to alternate.)*

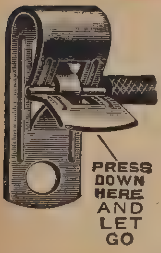
Canada—CBC's international beam to Europe is scheduled CKNC, 17.82, 0845-1800; CKCX, 15.19, 0845-1100; CKCS, 15.32, 1105-2300, all daily. The beam recently inaugurated to New Zealand, Australia, and the South Pacific by CBC is transmitted at 0245-0400 over CHOL, 11.72, and CHLS, 9.610. Good reception reported from "Down Under."

Celebes—Radio Makassar is being heard with improved signal on 9.265, both East and West Coasts. Has "terrific" signal in New Zealand, using many *English* recordings; best on 9.265, but is also heard (poorly) on 5.060; scheduled 1730-1830, 2300-0130, 0500-0930. (Cushen) On Mon., Wed., Sat., has news at 0800; signs off with "A Perfect Day." (Anderson, California)

China—XGOA, 15.35, has been widely heard in the East mornings this summer, around 0745 (when Boston leaves that channel) to about 0920 when appears to leave the air, though is officially scheduled to 1000; news at 0800; fair to good signals, but has

Fahnestock Clips

RADIO'S GREATEST CONVENIENCE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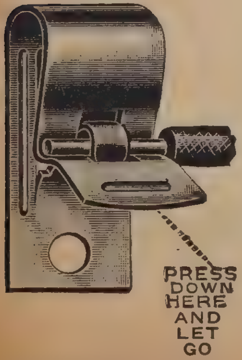
No tools required to make the connection. Grips the wire with just the right pressure for good electrical contact. Simply press down, insert the wire and let go. Does not injure wire, hence connection can be made or opened as often as desired. Available in large variety of types and sizes to fit any radio purpose and any requirement as to position, space or method of attachment. You will find them in the better sets.

Positive contact; cannot jar loose. Brass or bronze—nonrusting.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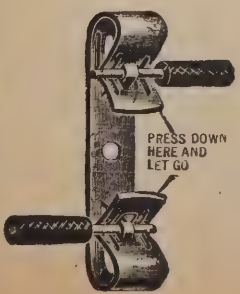
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Operation from 110-117 volt, 60 cycle source, power consumed 40 watts. Self contained power supply.

COMPLETE WITH TUBES

Within the ranges of the FM and television IF freq and the Police, Taxi, Aircraft, RR. etc. VHF. Instruments are individually hand calibrated and use an accurate vernier-scale planetary dial.

A combination signal generator and heterodyne wavemeter. It consists of a 5 megacycle crystal-controlled oscillator used as frequency standard calibrator, a variable two-range oscillator, an untuned detector with two stages of audio amplification, a sliding-rod stub antenna, a rough pi-type RF attenuator, a frequency calibration chart and a power supply. Coverage of the test oscillator on the low range setting is from 8 to 15 megacycles; the high frequency range coil covers from 45 to 76 megacycles and since the third harmonic is utilized, this gives a coverage of from 135 to 230 megacycles.

The signal generator cabinet measures 19½" wide, 12" high, 7½" deep; weight 50 lbs. Tubes in BC-1298 Power Supply — 16 — 6SN7GT; 1 — 5Y3GT/G; 2—6H6; 1—6SA7; 2—6V6GT; 1—6SJ7. Tubes in 1—222-A: 1—6J5; 2—9006; 2—6SJ7; 1—5Y3GT/G. **An additional extra power supply and tubes, with many other small items including cables packed in wooden chest is included in this price. Gross wt. of entire equipment 490 lbs.**

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No. RA91A—Selenium plate, full wave 115 or 230v AC; 50-60 cycle, single phase input; output is 6 to 48v DC at 2 to 15 amp; manually controlled, complete with overload input and output switches. 0-15 amp DC meter. Excellent for laboratories, servicemen, service-stations. Shipping weight 150 lbs.
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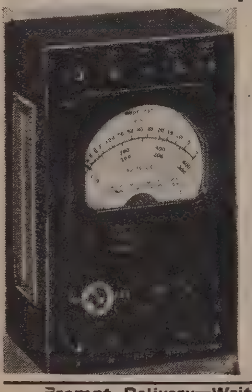
SUPREME—Model 537 VOLT-OHMMETER $9.95

BRAND NEW—EXPORT PACKED
3" Full Vision type Scale, with basic 100 Microampere D'Arsonval type movement.



A completely self contained pocket type multimeter, with functions for the measurement of DC voltage from 0.1 to 600 volts in 4 ranges. Measurement of resistances from 1 ohm to 1,000,000 ohms (1 megohm) can be made in 4 ranges. Height 5¾", width 3⅝", depth 2 7/16". Shipping weight 3 lbs. Complete with operating instructions and circuit diagram.

Prompt Delivery—Write Dept. RNS
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usual poor modulation; announces as "The Voice of China in Nanking," while XGOY *still* announces as "The Voice of China in Chungking." Heard best on West Coast around 0900, according to Balbi; 9.73 appears in dual and seems to continue *after* 0920.

On 15.35, XGOA was heard at 2200 one night announcing the (supposedly) North American beam, scheduled for around 2000-2300. (Sutton) Consistent reception of XGOA on this frequency at night is impossible due to other occupants (Boston and Paris), with Moscow using adjacent frequencies on either side (15.340 and 15.360). What I consider a "freak" pick-up was XGOA on 9.73 which I logged here in West Virginia on July 4 at 2150-2200, through bad QRM; woman was heard announcing the station distinctly (in *English*); on numerous subsequent evenings I was unable to pick up anything more than a heterodyne which *may* have originated with XGOA. (Incidentally, Leipzig is heard well on this spot from 2200 sign-on.) The 9.73 XGOA channel is heard here in the East around 0500-0630 or later, with fair level.

Chinese stations have been coming through much better this summer here in the East. XGOY, 11.913, best around 0500-0530, asks for reports; on 15.170 is heard some mornings signing on at 0745, but soon is buried by Guatemala *except* on Sundays when is heard fair to good until around 0845 fade-out; can be separated from Moscow's 15.170 during Soviet North American beam, 0745-0815; the 9.958 channel, used 0535-0735, is badly QRM'd by Brisbane's VLQ3, 9.66, but some mornings has been readable at 0600 when has news.

XRRA, Peiping, on its 10.260 summer frequency, has been audible in the East around 0600-0730; at 0630 a man often gives call in *English;* reported by Kary and heard also by your editor; does not appear to carry Nanking *(English)* news at 0800, this being confirmed by Dilg, California; according to Balbi, usually signs off at 0945; on occasion seems to use 15.130 (Nankervis).

XORA, 11.725 (moved from 11.69—Dilg), Shanghai, and XTPA, 11.65, Canton, have been weak signals here in the East this summer, usually audible to fair around 0500-0600.

XLRA, 11.490, Hankow, is heard in Australia around 0645 with musical program. (Sanderson) Sign-off is irregular, usually around 0945. (Balbi) Chinese sources list frequencies of XLRA as 6.054 and 12.500. (Cushen)

XGOUS, 9.123, Nanking, used for press dispatches, has lately been heard as late as 1000; usually begins around 0800, may have breaks. (Balbi)

XMTA, 12.21, Nanking, is heard in Australia at 0430 with western music. (Sanderson) Has been heard on occasion this summer in East around 0600. (Kary)

Ethiopia—Radio Addis Ababa is again active on "given" frequency of 15.074, but appears to be as low as 15.050 to 15.060 where has interference from WNC-7, Hialeah, Florida, which is used widely daytime for contacting South America. In Eastern U. S., *Radio Addis Ababa* has been heard from around 1325 fade-in to 1500 sign-off, playing both *ancient* American popular recordings and oriental music, with announcements in *English* and Amharic; on July 4 presented several Americans now living in Addis Ababa who sent greetings to friends in the States. Has been heard in Britain early as 1220 and testing around 0800-0954, according to Pearce. Dilg, California, has heard this station around 0845-1000, while here in the East I have received it as early as around 0700-0900. In the afternoon period, peak is towards sign-off. There is considerable interference from WNC-7 and CWQRM, but some afternoons the signal is quite good; usually is readable.

Call for broadcast seems to be ETA while ETA*A* is used for c.w.; usually can be heard on c.w. to New York following end of broadcast at 1500. Asks for reports; QRA is Technical Director of Radio Services, Ministry of Posts, Telegraphs and Telephones, Addis Ababa, Empire of Ethiopia. (Kary)

Finland—Helsinki's 15.193 (announced) is heard well in Eastern U. S. around 1925; comes on with chimes and music (probably National Anthem); short newscast follows; announces 9.500 in dual, and that a further newscast (also in *English*) is given "weekdays" on these frequencies at 0715. I do not hear the 0715 period due to Delhi operating on 15.190; and because of other stations in vicinity of 9.500 at that time.

The *Finnish Radio* has ordered one 100-kw. transmitter from a British radio firm; this is a prewar project, but is just now being realized. The new station will be set up at Bjorneborg "Pori" and will be completed for operation in a year and a half. It will be used largely for broadcasts to North America. (Anderson, California)

French Indo-China—A recent report by Paul Dilg, California, was acknowledged in a broadcast from *Radio Dalat;* among other items it was mentioned that identification slogan is "Ici Radio Dalat L'Lemetteur." Announced frequencies are 7.146 and 7.538; Mr. Dilg reports he has not heard them on the first channel, although some months ago 7.538 had a good signal early mornings; also has been heard on about 7.390, but a late flash from Mr. Dilg indicates *latest* frequency in use is 7.275, this being also reported by Nankervis; schedule appears to be around 0715-0845, sometimes to around 0852, news in French 0800. QRA is simply Radio Dalat, Dalat, French Indo-China (Indo-Chine).

Germany — *Nordwestdeutscher Rundfunk,* 6.115, Hamburg, was heard at 0750 asking for reports in *English* and French to North West German Network, Short-Wave Section, Hamburg 13, Rothenbaumchaussee 132;

ELECTRONIC EQUIPMENT BARGAINS

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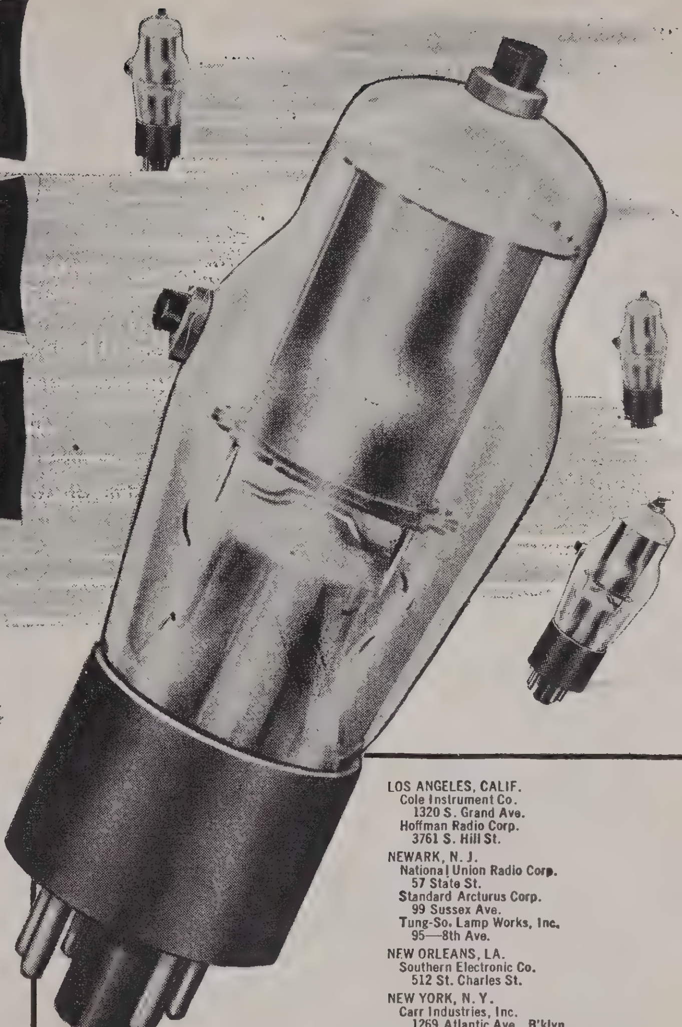

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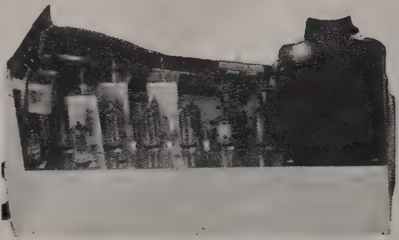

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appears to take broadcasts on occasion from Cologne, Hanover, and other points. (Pearce) I understand this station normally uses only the German language. Subsequently, this station has verified for Mr. Pearce, giving power as 50 kw. Heard in New York nightly signing on at 2200. (Beck)

India—Recently, best signal here in the East from Delhi on the 0730 news period has been on 17.760; 9.670 has been inaudible to only fair, while 11.830 has been weak. The 15.160 outlet (mostly in native) is a fine signal in the East mornings; usually carries the *English* news at 0930. The 15.190 channel is heard well with news at 2130 and 2230; it is a good signal mornings, in native.

Iran—During the summer, EPB, 15.100, Teheran, has been audible here in the East around 0700-0730 sign-off; news is read at 0715 by a man who during the period mentions occasionally, "This newscast is coming to you from Teheran, Iran." The news lasts only about 10 minutes, is usually followed by a popular recording or two, after which a woman appears to sign-off the station in an Eastern language (presumably Arabic). Announces 49-m. outlet (6.155) in dual.

Ireland—Radio Eirrean is again being heard in Eastern U. S. on 9.595 around 1610-1630 with news. Kary, Pennsylvania, reports weak signal from 17.840 around 1240-1300 with news. Asks for reports from North America.

Italy—Pearce, England, reports a station announcing as "Radio Italiana," on approximately 15.120, heard around 0730, with singing of nightingales at intervals.

Jamaica—ZQI, Kingston, is currently operating on 4.95, 1600-1730, and on 3.480, 1930-2200; preview and headlines at 1600; news 1715; preview and headlines, 1930; news 2100. Recently, the Jamaica Government announced through the press and over this station that they proposed to terminate broadcasting on their own account, and to permit private commercial broadcasting in Jamaica under franchise, that is, under regulations laid down by themselves. Relays over VRR-4 and VRR-5 from ZQI have been widely reported lately from all over the Western Hemisphere, Australia, South Africa, and the Continent of Europe. (Stone)

Java—Batavia, 9.555, now from 0500. (Sanderson) This outlet appears in parallel with 10.365 and about 4.870. (Dilg) The 9.555 frequency has been heard in New Zealand with news at 0600. (Gray) Uses 5-note bell. (Cushen)

Kenya—Nairobi has been drifting lately, often nearer 4.860 than listed 4.885. (Pearce) May be experimenting to find clear channel. Is heard in Britain around 1300 and earlier.

Luxembourg—Radio Luxembourg, 6.090, is heard well in Britain; on Sundays has request program with

(*Continued on page* 175)

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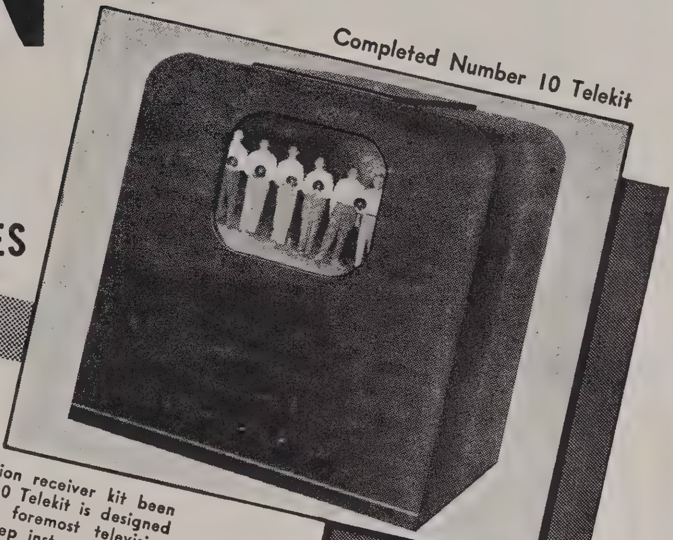
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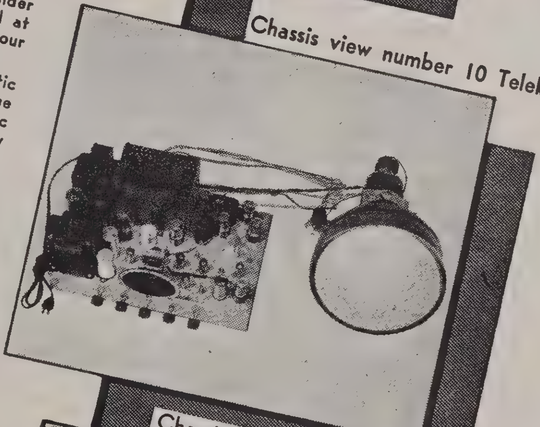
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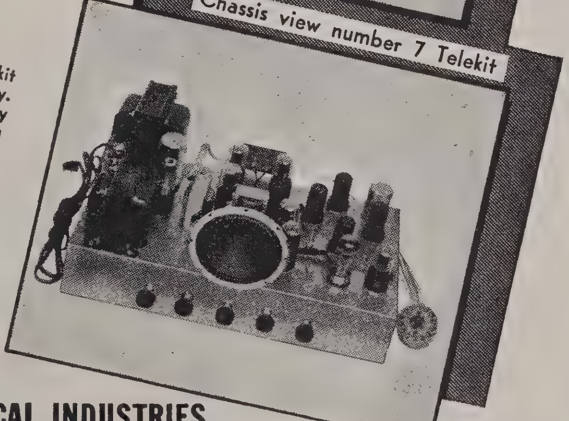
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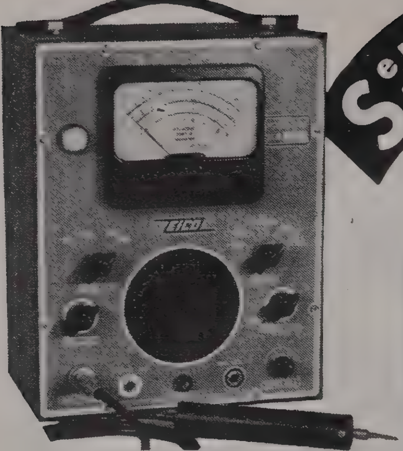

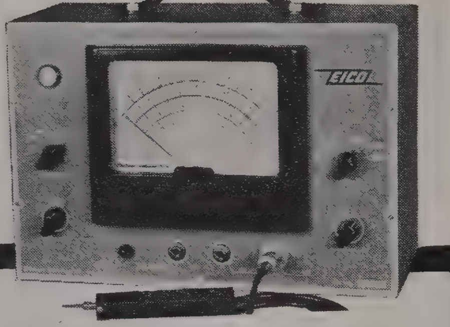

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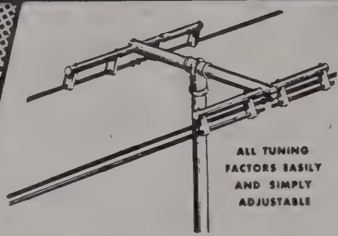
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Sound Recording

(*Continued from page 64*)

1000 cycles can be altered considerably by changing the degree of angle of incidence, that is, by rotating the frontal surface of the microphone in a horizontal plane so that impinging sound waves strike the diaphragm at an angle other than that of the usual zero degrees as formed by the arrival of sound waves from a point directly in front of the microphone. (See Fig. 6). Low frequency response is not appreciably affected by such angular changes.

By studying the cross-sectional cutaway shown in Fig. 5, one gains an insight into the extreme simplicity of construction. The microphone elements are housed in a metal shell and covered with a metal grill and silk cloth to prevent damage from foreign particles and to minimize dust collection. A metal ring which screws over the housing holds the diaphragm in place. The microphone itself consists of a circular duraluminum diaphragm to which is attached a coil of aluminum ribbon, wound in an edgewise manner and suspended in the radial field of a cobalt steel permanent magnet. Movement of the diaphragm and its associated coil cuts the magnetic lines of force surrounding the magnet and generates an alternating output voltage which is proportional to the magnitude of the original sound waves.

An explanation of the improvement in frequency response of this microphone over that of previous types lies in the inclusion of an acoustic compensating circuit which consists mainly of a properly designed air chamber between the housing and microphone elements and an air vent tube, the length and diameter of which control the compensating action of the air chamber. These constants have been critically adjusted at the factory and should not be altered in any manner.

The output of the 618-A is approximately —84 db., and its output impedance, like that of most dynamic or pressure operated microphones, is 30 ohms.

The Nondirectional Dynamic

An improvement over the 618-A is the *Western Electric* 630-A, familiarly known as the "Eight-Ball" because of its sphere-shaped housing (Fig. 7).

It is well-known that any object placed in the field of either primary or reflected sound waves will cause a diffraction of those waves. When the object is a microphone, such diffraction results not only in angular distortion but, more important, causes a change of pressure of the sound waves reaching the diaphragm. The amount of pressure change is dependent not only on the angle of incidence and frequency of the approaching sound waves, but also on the physical size and shape of the microphone.

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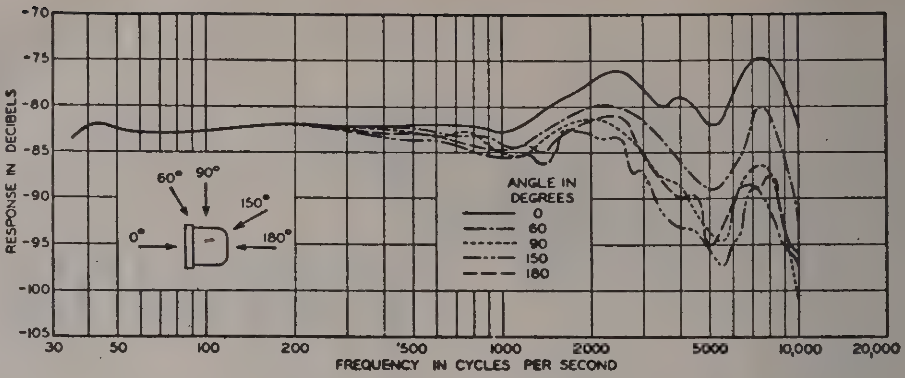


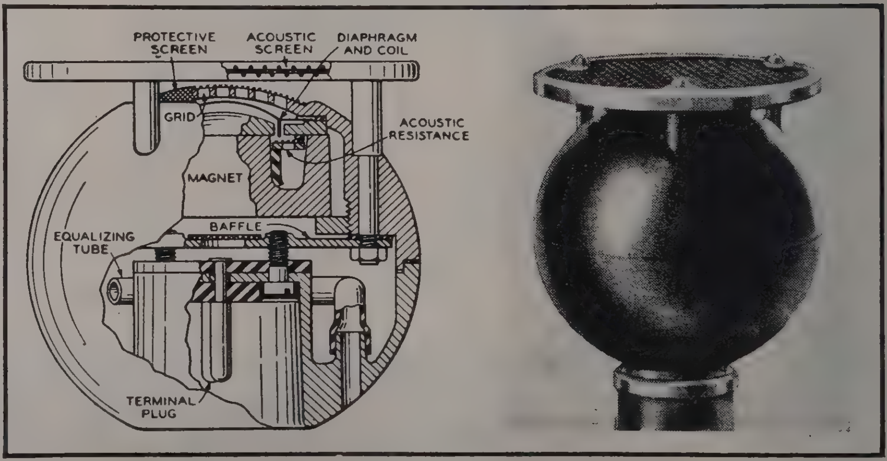
Fig. 6. Angular response of moving coil microphone.

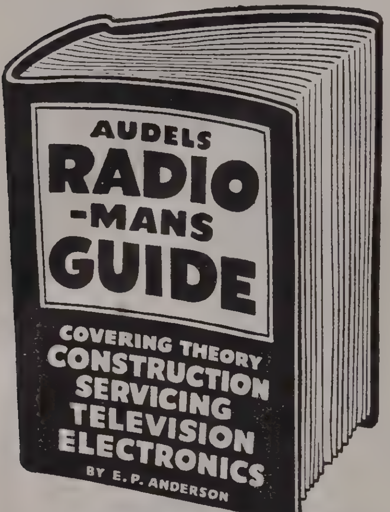
Because of a tendency to discriminate between various angles of wave frequencies above 1000 cycles, the microphone assumes a directional characteristic whose factor does not maintain a fixed value, but rather varies in accordance with changes in both the frequency and in the angle of incidence of the impinging sound waves. This action gives rise to phase distortion in the output of the microphone. Since the over-all size of the microphone is one of the basic factors involved, it is assumed that this problem could be solved by decreasing the physical dimensions of the housing and microphone elements. However, theoretically, a microphone so constructed as to present no angular discrimination over the normal audio frequency range would be impractical because of its extremely small size, delicate construction, and inherent loss of output. Such a unit would require that an additional preamplifier be used. It, therefore, holds that the shape of the housing, which is another basic factor, is the solution to this particular problem.

Tests made by engineers of the *Bell Telephone Laboratories* on the effects of various shaped objects on sound wave diffraction, produced conclusive data which resulted in the selection of the spherical-shaped housing as the best suited in reducing directional distortion. Referring to the cross-sectional diagram in Fig. 7 it can be seen that the microphone is divided into two parts, with the microphone itself, comprised of diaphragm, coil, magnet, and acoustic resistance, in the top of the shell. The lower half, whose bottom section is recessed to hold the connecting terminal plug, contains an air chamber and equalizing tube. This rubber tube, cut to its proper length at the factory, is used to increase the low frequency response and to compensate for differences in air pressures inside and outside the shell. The two halves are separated by an acoustic-resistance baffle, which essentially is a flat metal plate perforated by six one-half inch holes to provide acoustic continuity between both sections of the housing. This baffle is used to prevent the occurrence of cavity resonance within the housing itself.

Ordinarily a microphone having its diaphragm mounted in a horizontal plane and normally facing upwards, exerts a marked tendency toward giving better frequency response to high-frequency waves reaching the diaphragm from various angles above the horizontal plane than for corresponding waves reaching it from below. This condition was overcome by the employment of an acoustic screen. This screen, two and one-half inches in diameter and surrounded by a protective metal ring, is composed of a wire mesh screening on either side of several layers of treated silk cloth, and mounted horizontally about one-eighth inch above the front of the diaphragm. By virtue of its resistance to

Fig. 7. The familiar Western Electric "Eight-Ball" microphone.





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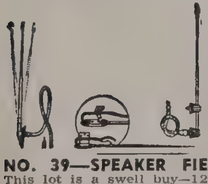

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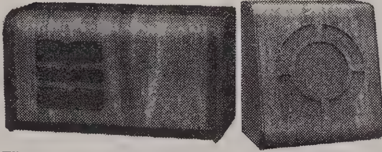

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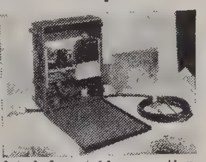

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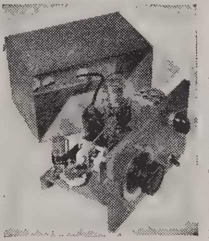

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sound waves, the screen tends to reflect waves coming from below the horizontal plane back into the diaphragm, thereby lending valuable sound reinforcement, and also acts to retard sound waves striking the screen from the front. The microphone response to varying degrees of angular sound approach is thereby made uniform.

The diaphragm is mounted as close to the front of the shell as is possible, a feature which is desirable in that the total angle of diffraction formed by the spacing between housing and diaphragm is reduced to a negligible degree, and at the same time a larger area is permitted in the air chamber behind the diaphragm. The useful amount of back-pressure thus formed is an important factor in the reduction of diaphragm vibration impedance. Protection of the diaphragm is afforded by a grid which is so designed as to offer added improvement in high-frequency response. Covering this grid is a screen of silk cloth which protects the diaphragm from possible damage from iron filings, dust particles, and other foreign matter.

Frequency response of this microphone is essentially flat from 40 to 10,000 cycles, without regard to angle of incidence.

Output of the 630-A is approximately —87db., or 3 db. below that of the 618-A, but this slight disadvantage is more than offset by its improved frequency response, lighter weight, compactness, and adaptability to a wider variety of uses.

The Velocity Microphone

The "velocity" type of microphone is so called because its action depends on the velocity of air particles rather than sound wave pressure. It is also known as a "pressure-gradient" unit, and more familiarly as a "ribbon."

The design of velocity or "pressure-gradient" units is represented in the development of the *RCA* 44-BX. With a uniform frequency response from 40 to over 10,000 cycles and an output level of —55 db., at a reference level of .001 watt, the 44-BX approaches the criterion in the combination of efficiency, sensitivity, shock resistance and streamlined ruggedness.

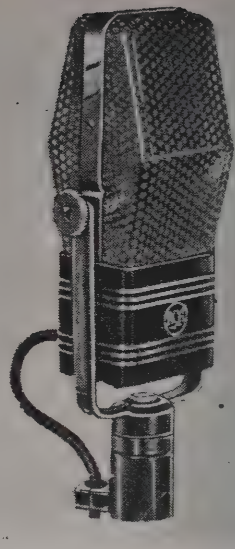
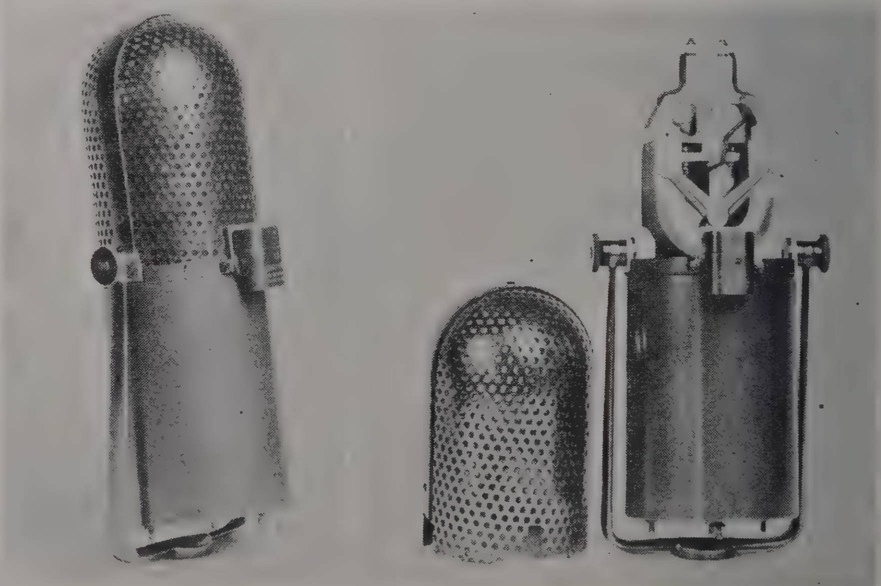


Fig. 8. The velocity microphone which is also known as a "ribbon type."

Construction of the 44-BX lies along conventional lines and is shown in Fig. 8. A thin corrugated aluminum ribbon, so designed and constructed that its natural resonant point falls below the lower limits of the audio frequency range, is suspended between the poles of two paralleled sections of a cobalt permanent magnet. As the length of the ribbon is perpendicular with respect to the plane of the magnetic lines of force and its width coincident with that plane, it follows that any movement of the ribbon in response to the pressure-gradient of impinging sound waves will cause the magnetic

Fig. 9. The RCA Model 77-A (left) and Model 77-D (right).



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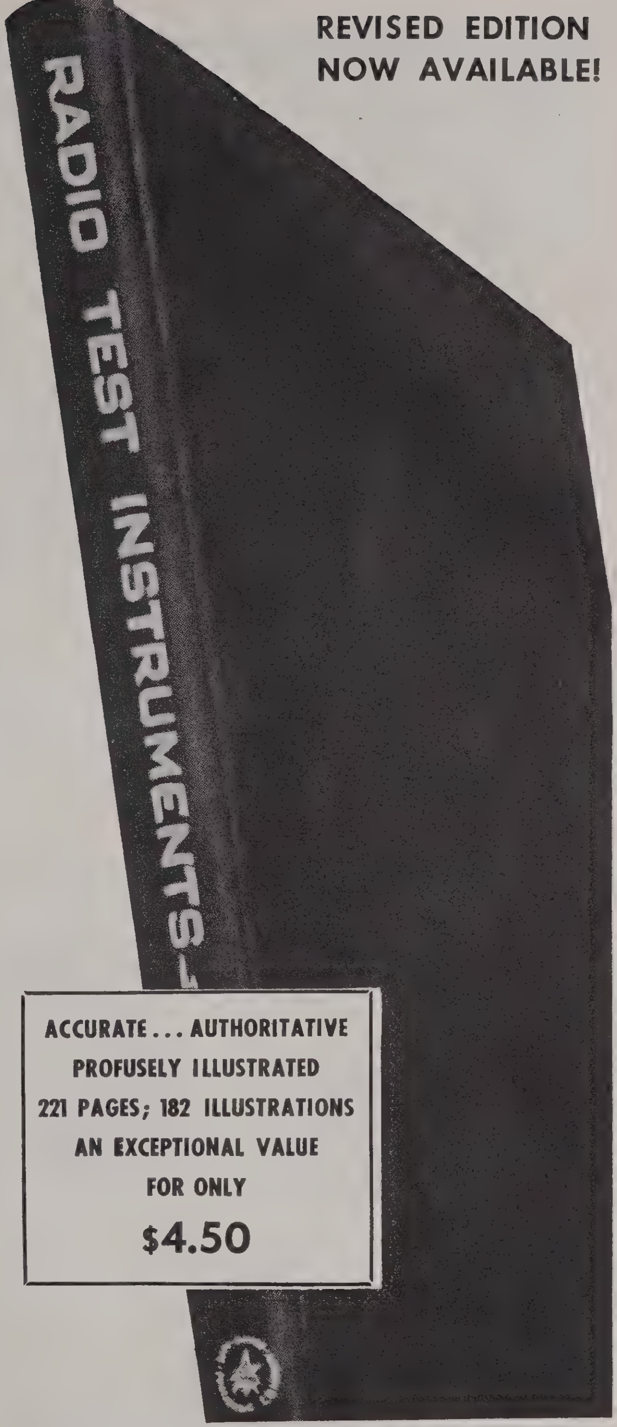

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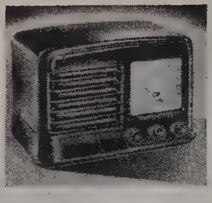

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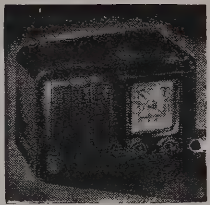

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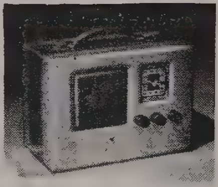

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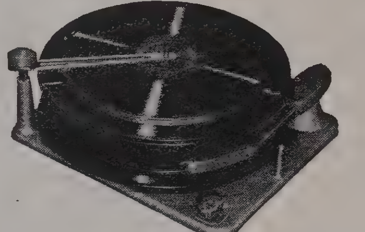

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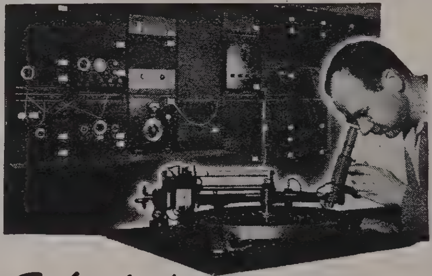

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Maximum sensitivity is evidenced toward sound waves approaching the microphone at an angle of 90 degrees to the plane of the ribbon, with a corresponding loss of sensitivity to waves approaching at an angle of lesser degree. Since sound waves traveling in a plane identical to, or parallel to, the plane of the ribbon exert little or no pressure upon it, the resultant response pattern of the microphone becomes sharply bidirectional. Specific applications in which this characteristic may be used to best advantage will be discovered by experimenting with individual setups.

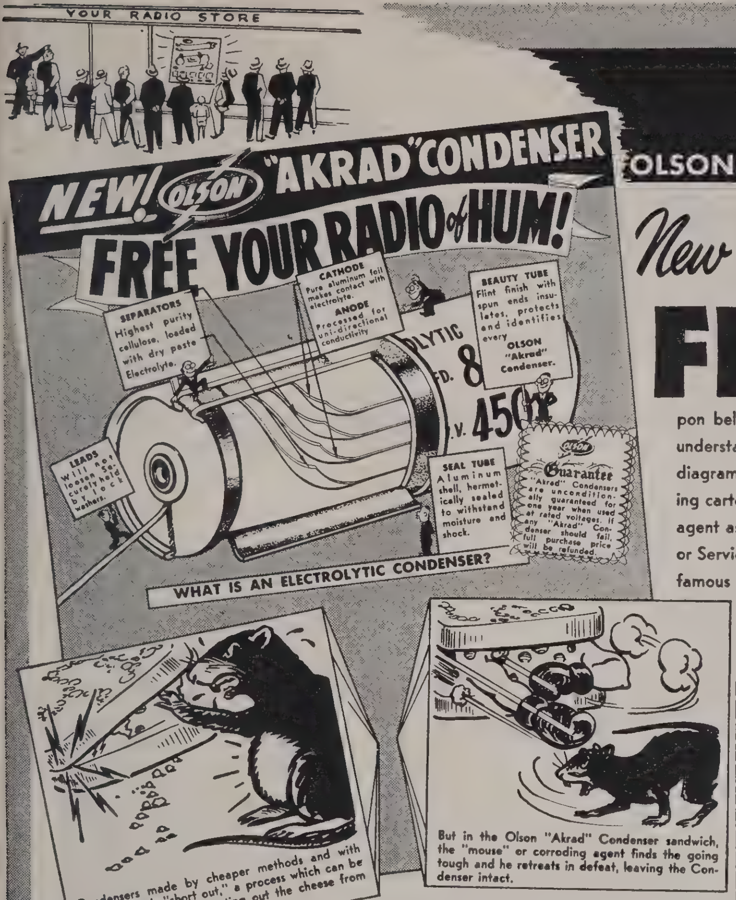
The Unidirectional Velocity Microphone

In the *RCA* 77-A unidirectional microphone (Fig. 9) the principle of operation, by virtue of the unique manner in which the ribbon is constructed, is much the same as that of the cardioid microphone. The corrugated ribbon is suspended vertically between the two halves of a permanent magnet, the field of which is cut in the usual transverse manner. The ribbon, however, is divided into two equal sections which operate independently of each other, the upper half being responsive to the pressure of sound waves and the lower half actuated by air particle velocity and acting as a conventional ribbon unit.

The upper section is made to operate as a pressure unit by allowing the ribbon to vibrate freely as usual, but with the back section enclosed in a metal housing terminated in an infinite impedance in order to prevent a rising response characteristic at the higher frequencies. A practical means of attaining such an impedance is by the use of a number of metal plates approximately ¾ inch thick and 4 inches in diameter, placed one upon the other to form a cylinder. The inside portion of each plate is spiral-shaped, with a small opening at the beginning and end of each spiral which corresponds with a like aperture in each succeeding layer of plates to form a continuous labyrinth, each layer being loosely packed with absorbent material to aid in reflection damping.

In the *RCA* 77-B, a long hollow tube, tightly packed with absorbent felt padding and coiled to facilitate overall compactness is used instead of the cylindrical labyrinth.

Since the output of the pressure unit may be expressed as unity, and since the bidirectional response is equal to the cosine of the angle of approaching sound, the combined output can be expressed as $E = E_o\,(1 + \cos\theta)$, or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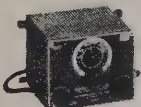

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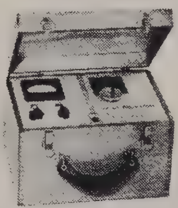

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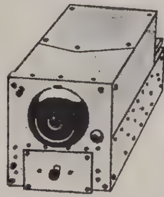

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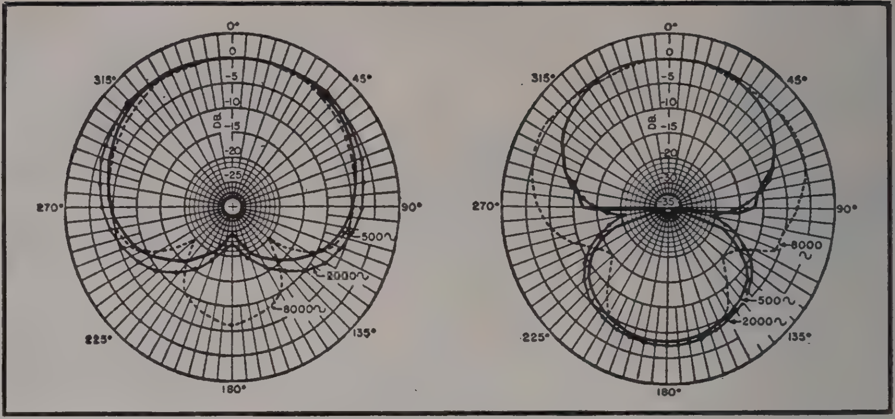


Fig. 10. Frequency response characteristics of the WE 618-A.

the familiar cardioid directive pattern.

This type of microphone has an output level of approximately —81 db., where 0 db. = 1 volt per bar (open circuit voltage) across a 250 ohm output impedance.

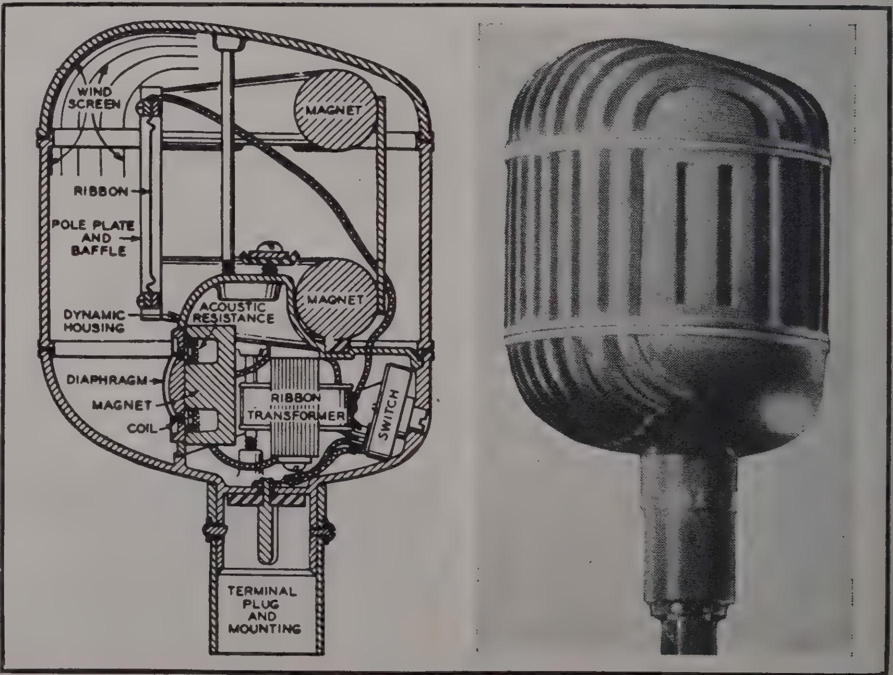
Referring to the characteristic pattern shown in Fig. 10, it is seen that maximum response is afforded to sound waves approaching at right angles to the lateral plane of the ribbon from the front side, while the small lobe as evidenced at the rear in the response pattern indicates practical elimination of sound waves from this direction. The advantages of such a pickup pattern lend the microphone to a variety of applications.

The Cardioid Microphone

An explanation of cardioid directivity is best given through a detailed examination of the characteristics of a typical cardioid microphone. Such a microphone is the *Western Electric* 639-A (Fig. 11), whose directive pattern resembles the heart-shaped or "cardioid" plot of the mathematical term ($1+\cos\theta$), hence its name. This pattern, which makes possible a wide-angle pickup of 120 degrees, is the result of the utilization of the combined outputs of a nondirectional dynamic unit similar to that of the 630-A and mounted vertically as a semidirectional unit, and a specially constructed bidirectional ribbon unit, both being housed in the same case.

It is well known that sound will flow around corners or curved surfaces and since the case holding the dynamic unit is so designed, sound waves approaching from the back of the microphone follow the rounded contour of the case to the front of the diaphragm, thereby causing it to move in the same direction in response to sound waves arriving from the back and sides as to those arriving from the front. Thus the diaphragm always moves in one direction only, and the output of the microphone maintains a constant phase relation. For this reason its output may be represented mathematically by a whole number, such as 1, or unity. The bidirectional velocity

Fig. 11. The Western Electric 639-A cardioid directional microphone.



unit, however, responds to sound waves approaching from two opposite directions, and as a result the ribbon reverses in phase each time the direction of sound is reversed. This phase reversal is proportional to the cosine of the angle of the approaching sound, and a combination of the two outputs $(1 + \cos\theta)$ approximates the true cardioid.

The unique structure of the ribbon allows a practically uniform response over the low and high frequencies as well as the middle frequency range. Normally, a conventional ribbon unit, when used in conjunction with a dynamic unit, tends to discriminate to some degree all frequencies above and below a certain medium range, resulting in an unbalanced condition of pickup with accompanying frequency distortion.

Physically, the ribbon designed for the 639-A is less than half the length of an average ribbon, is decidedly narrower, and is corrugated at either end, with its center section straight in relation to the front of the microphone. Since this portion is concave to the back of the microphone, it presents slightly more acoustical resistance to sound waves traveling in this direction than to those arriving from the front, thus aiding in equalizing the pickup from both directions, and presenting a closer approach to a true bidirectional pattern. This form of ribbon construction also affords less resistance to wind, prevents possible twisting of the ribbon, and contributes to its over-all ruggedness.

General construction of the 639-A is shown in the cross-sectional diagram of Fig. 11. The three-position switch in back of the housing is slotted for screw-driver operation, and allows selection of three directional patterns—*C* for cardioid, in which both units are combined; *D* for dynamic, in which the pressure unit alone is connected; and *R* for ribbon. In the 639-B six positions are available, the extra three being used to give varying degrees of directivity to the cardioid pattern.

Output impedance of the 639-A is 30 ohms, and its output level is −85 db. with reference to 1 volt/bar or .006 watt.[3]

(To be continued)

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[3] Ledbetter, John B., "Broadcast Microphones" Radio-Electronic Engineering Edition of Radio News, June, 1946.

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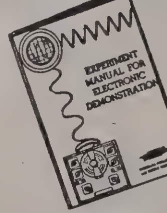
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What's New in Radio

(Continued from page 80)

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POCKET TEST INSTRUMENT

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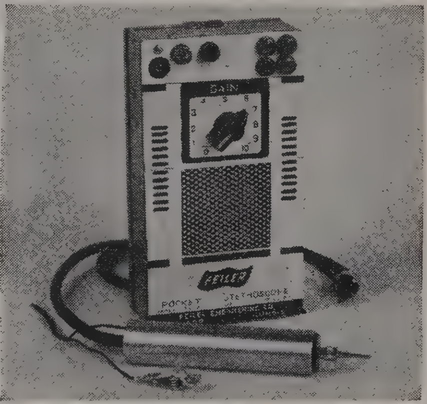
The probe is of the high-sensitivity type and has a built-in high gain miniature tube. Actual amplification is provided at the signal point and a 3" PM dynamic speaker gives positive response for the tracing operation.



The gain control is continuously variable. Provision has been made for connecting this instrument to any standard type voltohmmeter or r.f. vacuum tube voltmeter. Any impedance headphones, either crystal or magnetic, or an output meter can be connected by means of a jack. Operation is on 105-125 volts, either 50 or 60 cycles.

Additional information will be supplied by *Feiler Engineering Co.,* 422 South Dearborn, Chicago 5, Illinois.

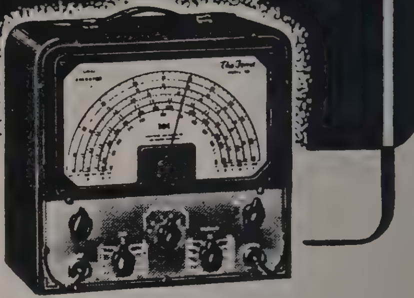
PLUG-IN ELECTROLYTICS

A new line of plug-in electrolytic condensers, especially designed for experimental, test, and other applications where quick condenser changes are required, is being announced by *Cornell-Dubilier Electric Corporation* of South Plainfield, New Jersey.

Designated the Type QC, the new units are hermetically sealed in round aluminum containers which are equipped with a four-pin octal base mounting which permits their ready removal or replacement in standard tube sockets.

The line is available in a popular range of capacity and voltage combinations, including multiple sections. Units for special requirements may be secured by special order.

SIGNAL GENERATOR
Wide Range FM-AM Television



Model 701

Range: 170 K.C. to 115 M.C.—all fundamentals.
Crystal calibrated, low loss permeability tuned coils. Internal 400 cycle sine wave modulation—to 100%. Follow-up shorting Turret coils with no dead spots.
Tubes: 6C4, 6AU6, 6X4.
Vernier drive — 9" easy-to-read scale.
Ladder attentuator —triple shielded. **$74 95 Net**

Write for catalog sheet
Dept. 9-A

Coastwise Electronics Co., Inc.
130 North Beaudry Ave., Los Angeles 12, Calif.
New York Office & Warehouse
258 Broadway, New York 7, N. Y.

"TIK" for KITS

Servicemen Amateurs Jobbers
Look at these values

Mica Condensers Assorted. 100 for	$3.49
Allen Bradley, etc., Volume Controls, 50 ohm to 1 meg 12 for	$2.59
Carbon Resistors, Color Coded, ½, 1 & 2 watt. 100 for	$2.50
Wire Wound Resistors, Ward Leonard, etc. 5 to 75 Watt. 20 for	$2.98
Fuses, Buss & Littlefuse. 100 for	$1.89
Assorted oil filled condensers, tubular and bathtub type, 400 V, 600 V, 1000 Volts. 12 for	$2.49
Octal and 4 prong Ceramic Sockets (without rings). 100 for	$3.98
Condensers, .05 mfd. 2000 volt to .25 mfd 3,000 WVDC. 6 for	$3.59
Precision Wire Wound Resistors, Shallcross, Mepco, etc., ¼, ½ and 1 Watt. 15 for	$2.98

SPECIAL COMBO KIT
OUR INTRODUCTORY OFFER
Excellent Assortment—Big Value—Tremendous Savings

This kit includes a quantity of items listed in the above kits, PLUS many others. It's our New Customer Special. **$10 98**

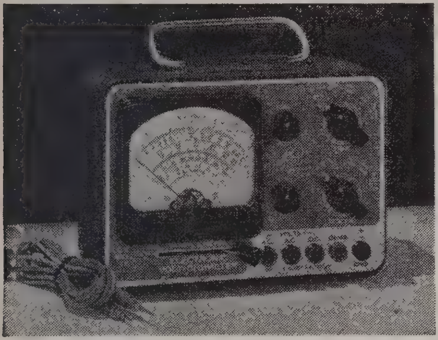
Minimum Order $2.00
25% deposit required on all C.O.D. orders
Add postage Write Dept. RNS-

"TIK"
55 WALKER ST.,
NEW YORK 13, N. Y.
phone CAnal 6-7485

Bulletin No. 100-425 which contains complete information on the line will be supplied by *Cornell-Dubilier Electric Corporation,* South Plainfield, New Jersey, to those requesting a copy.

PORTABLE VOLT-OHMMETER

The Hickok Electrical Instrument Company of Cleveland, Ohio has just introduced their new Model 214 portable electronic volt-ohmmeter, a completely self-contained, battery-operated unit for servicemen.



This unit may be used in rural areas or for checking radio receivers in the field. For resistance or voltage tests, sets need not be removed from autos, ships, or aircraft. The unit is built for self-checking of battery condition at any time and is usable for 1350 complete cycles of 4 minute operations.

The Model 214 has six a.c. voltage ranges, 0-3, 12, 30, 120, 300, 1200 and six d.c. ranges, 0-3, 12, 30, 120, 300, 1200 and covers from 1 ohm to 1000 megohms in six ranges.

The unit weights 5¼ pounds and measures 8¼" x 6" x 4¼". Complete details will be supplied by *The Hickok Electrical Instrument Company,* 10524 Dupont Avenue, Cleveland 8, Ohio, upon request.

CUSTOM INSTALLATION FM-AM

Of interest to radio servicemen is the new line of radio chassis designed for custom installation which is now being manufactured by *Espey-Philharmonic Radio Co.* of New York.

One of these units, the Model 7-B, is an 11 tube superheterodyne AM-FM receiver designed to operate on 105-125 volts a.c., 50-60 cycles. This receiver features a.v.c., full-range volume control, full-range combination bass-treble tone control, 13 watt push-pull audio output, loop antenna for AM and folded dipole for FM recep-

SAVE AT JOSEPH'S

POPULAR TUBES!!!

AT POPULAR PRICES

1G5
1R5
1S5
1T4
6SJ7
2C26
3B7
3S4
5R4
5U4
6AB7
6AC7
6AG5
6AG7
6C4
6F6
6H6
6J5
6J6
6SA7
6SG7
6V6
6X5
6Y6
6F6

YOUR CHOICE 50c

7N7
12AT6
12BA6
12BE6
12SA7
12SF7
12SG7
12SK7
12SN7
12SQ7
31
35L6
35W4
35Z4
50B5
VR105
954
955
956
9006

2C40—**$2.50** 3B24—**$3.00** 5CP1—**$3.95** w-socket 715B—**$3.00** 724B—**$1.00**

SPECIAL BONUS: Deduct 10% for orders of $20.00 and over on all tubes.

HOT DEALS!!!

Special!

PAPER CONDENSER ASSORTMENT

100 Brand New Paper Condensers. No Odd values. All 200-600 WV from .001 to .25 MFD.

You Can't Miss At

$3.85 per kit

Special!

RESISTOR ASSORTMENT

100 Carbon and Wire Wound Resistors. ½-1-2-5-10 W. No Odd values. All Brand New Stock.

A Real Buy At

$1.95 per kit

Special!

MICA CONDENSERS

50 Mica Condensers for the price of 10! .00001 to .05 MFD. 300 to 600 V.

Unbeatable Value at

$1.95 per kit

35 W 110 VAC AMPLIFIER KIT 7 Tube

COMPLETE with tubes, etc.

$19.95 per kit

Two 6L6 push-pull. 4 Controls. 3 inputs. Everything mounted on beautiful gray enamel chassis.

ELECTROLYTIC CONDENSERS

30x30—150 V; 20-25 V Paper Electric Condensers. Each........................**50c** 10 For....**$3.90**
8x8—475 V Metal Can Condensers..........Ea. **75c** 10 For..**$6.00**
2x50—50 V; 2x30—350 V; 2x30—Neg.; One Can. Ea..................**$1.00** 10 For........ **8.00**

Radio-F.M.-Television-Electrical Parts

25 Lbs. of USABLE PARTS

WE ARE SWAMPED with tremendous quantities of parts that cannot be placed in our regular stock. We MUST SELL at the Ridiculously Low Price of—**25 Lbs. For** **$3.00**

WHILE THEY LAST!

SCR-694 BC-1306
U. S. ARMY LATEST
MOBILE TRANSCEIVER

- *Contains Ten Tubes, plus Fifteen Spares.*
- *Freq. Range: 3800-6800 KC.*
- *Compact Unit: 6"x9"x14".*
- *Superhet Receiver.*
- *Transmitter with Modulator and B.F.O.*
- *Operates from 6, 12, 24 V Vibrator Supply.*
- *Can Be Operated Easily by One Person.*

GUARANTEED TO CONTAIN EVERYTHING TO OPERATE, INCLUDING GN-58, HAND GENERATOR, ANTENNA, MIKE, PHONES, etc., etc., etc!

Gross Shipping Weight —205 Lbs.

BRAND NEW! ORIGINAL CRATE! ONLY $49.50 F. O. B. Chicago

All items listed above are subject to prior sale. Terms, cash with order F.O.B. Chicago, Ill. Please remit postage charges. Attention Manufacturers: Write us your requirements.

IRVING JOSEPH ★ Radio Parts
220 S. Halsted St. **Chicago 6, Ill.**

10 inch
TELEVISION
now 124.50 LESS TUBES

AMAZING LOW COST

Designed by Television Training Institute of Philadelphia—where thousands of students in this and other leading television schools assemble Telekits as part of their training.

Thorough, easy-to-follow, step-by-step instruction books included with each Telekit. Pictures, schematics, diagrams and service notes.

New TTI interlock circuit for horizontal and vertical sync control—holds the picture steady even at low signal strength and at noisy locations.

High quality FM sound reception—without distortion to give you true listening pleasure.

Pre-tuned I.F. coils making alignment simple.

Switching arrangements for five bands.

GUARANTEED TO WORK—Ask your jobber about the authorized service station plan. There is one in each Television city.

Remember, No. 10 Telekit is a full ten inch television receiver kit that is comparable to commercial receivers. No. 10 cabinet $29.50. No. 10 Tube Kit with all tubes (including 10BP4) $64.50.

SEVEN INCH TELEKIT $77.50
(LESS TUBES)

Number Seven Telekit is easy to assemble. Perfect set for the television beginner that is Guaranteed to receive sound and video of an excellent quality. Complete instruction books with each kit.

See the Telekits at your jobber or write for FREE BOOKLET.

TELEKIT
ELECTRO-TECHNICAL INDUSTRIES
121 NORTH BROAD STREET PHILADELPHIA 7, PA

tion, and provision for phonograph operation.

The chassis is 13½" x 9" x 9" and is ready to be installed in either a table cabinet or console, or any other piece of furniture adapted as a cabinet.

Details on the entire custom installation line of radio chassis will be furnished by *Espey-Philharmonic Radio Co.*, 528 East 72nd Street, New York, New York.

HAND TRUCK

The Handees Company of Bloomington, Illinois are featuring a new appliance and industrial hand truck, their Model 88R.

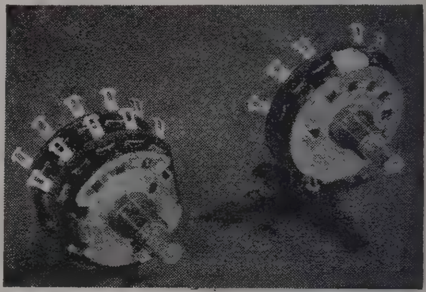
Designed particularly for the handling of large items, refrigerators, console receivers, and crated merchandise, this truck has a load capacity of 1000 pounds and is constructed of tubular steel. Standard equipment includes a heavy web strap 12 feet long complete with non-slip buckle and protective tip. A removable nosepiece of ¼" steel plate 24" wide provides for easy handling of larger items. The truck is 54" high. The dual-mounted solid rubber wheels are equipped with Chrysler Oilite bearings which are prelubricated.

Full details on the Model 88R, including price, will be furnished upon application to *The Handees Company,* Dept. 777, Bloomington, Illinois.

NEW SWITCHES

Production on two new single and double section switches has been announced by *P. R. Mallory & Co., Inc.* of Indianapolis.

Designed to be used where space and low cost are governing factors, these new circuit selector switches have identical section and terminal design as those of the Model RS-50 and RS-60 switches. These units, which may be used for band and tone control switching in radio receivers and other electronic applications where medium and low torque indexing action is desired, are known as the RSA-50 and RSA-60.



Either of the models is available in one or two section construction. The RSA-50 accommodates up to twelve terminals on either side of the section and provides from 2 to 6 positions. The RSA-60 accommodates up to ten terminals on either side of the section and provides from 2 to 5 positions. This latter model has a narrow section design which is suitable for under-chassis mounting where space is at a premium.

Data sheets and complete specifications on these new switches will be furnished upon request. Address inquiries to *P. R. Mallory & Co., Inc.,* Indianapolis, Indiana.

BUTTON-CONTROL FLOOR STAND

Electro-Voice, Inc. of Buchanan, Michigan has announced the availability of a new Utility Model 430 button-control floor stand for studio, p.a., and recording work.

A single red button provides instant fingertip control of shaft height. The

When Radio Products Sales, Inc. of Los Angeles opened their new building approximately 5000 persons turned out to look over the company's complete line of radios, appliances, ham gear, and electronic equipment. This well-planned sales floor has been designed to provide customers with the most modern shopping facilities. A 50-car parking lot adjoining the building is provided for the convenience of the customers.

TERRIFIC... say users of "Premier"

BAND-SPREAD DIAL

SIGNAL GENERATOR

EXCLUSIVE FEATURE!

The "PREMIER" Model 570 is the ONLY low-priced Signal Generator with a MICRO-MASTER BAND-SPREAD DIAL, equivalent to a scale length of approximately 60"—a major feature for logging, sharp and critical tuning.

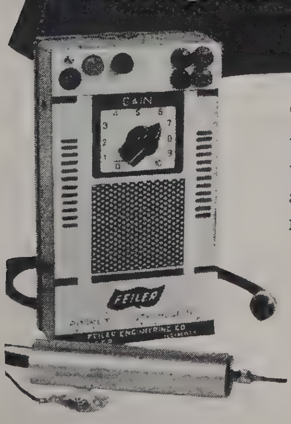
- AIR TRIMMERS ON ALL BANDS.
- TRIPLE COPPER PLATED SHIELDING.
- EFFECTIVE LINE FILTER—pure 400 cycle modulation (less than 5% distortion).
- Range 75KC-50MC on fundamental, and 50-150MC on 3rd harmonic, useful for aligning FM and Television Receivers.
- Accuracy better than 1%.
- A.C.—115 volts, 50-60 cycles.
- Overall size—12"x12½"x5½". Shpg. wt. 21 lbs.

Manufactured by Premier Electronic Labs., N.Y.C.
Immediate Delivery!
Complete with co-axial cable and operating instructions.
25% deposit, balance C.O.D.

$54.75 NET

METROPOLITAN ELECTRONIC & INSTRUMENT CO.
Dept. RN-9 42 Warren Street New York 7, N. Y.

Fixing Radios the Old Hard Way?



The **Feiler Stethoscope** does everything but make the actual repair. And the **Stethoscope** does it faster, better and much easier. Thousands of radio men, many with little experience, are already fixing radios and other electronic equipment this new way.

You will find that just this one low priced unit and a few basic hand tools are all you need to fix practically any radio.

Here is the new Model TS-5 **"Pocket Stethoscope"** built to take out on the job. It's light, compact and rugged yet performs like the bench models. Stethoscopes are available in 4 types ranging from $9.85 to $34.95.

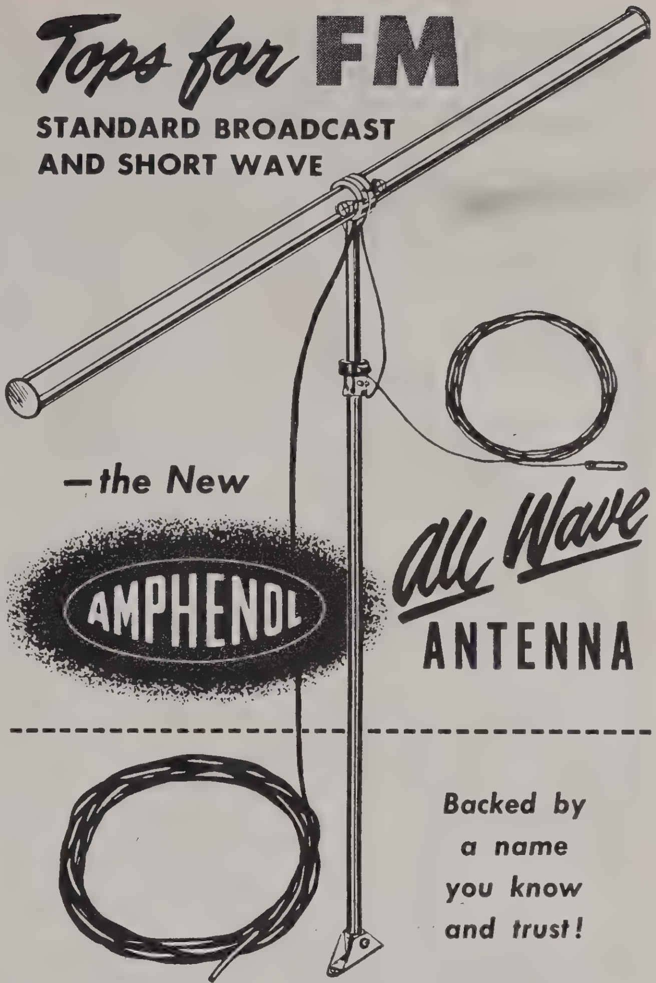
The "Inside Story" of the STETHOSCOPE—how it works—how it instantly locates trouble in any circuit—is yours for the asking. Just send us your name and address on a penny post card or see your Jobber.

Available for Export — Choice Territories Still Open

FEILER

"MAKES RADIO REPAIRS AUTOMATIC"

FEILER ENGINEERING COMPANY
422 South Dearborn St., Dept. 1G7, Chicago 5, Illinois



Tops for **FM**

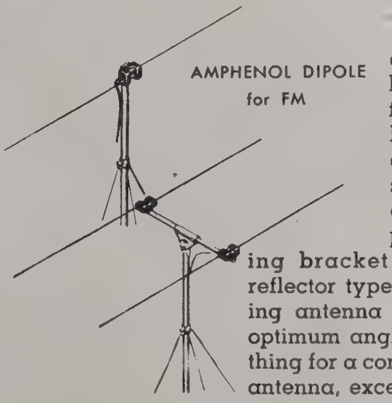
STANDARD BROADCAST AND SHORT WAVE

—the New

AMPHENOL *All Wave* **ANTENNA**

Backed by a name you know and trust!

- In actual tests, over the 500 kc-108 mc frequency range, the new Amphenol All-Wave Antenna out-gains the best double doublet. It assures interference-free reception, even in areas of low signal strength.
- The All-Wave Antenna combines a horizontally polarized FM dipole with a 65-foot copper wire antenna for standard broadcast and short wave. A special wave filter channels energy to receiver input. A leadin of 52 ohm coaxial transmission line reduces interference to the minimum.
- The All-Wave Antenna is individually packaged for unit sale with installation instructions, all hardware (except guy wires), and a guy wire clamp.



AMPHENOL DIPOLE for FM

- Amphenol dipoles, and reflector arrays, build up ample gain for finest reception of FM. Efficient, even in areas of low signal strength, they virtually eliminate multipath reception. Mounting bracket and masthead (of reflector types) swivel, thus allowing antenna plane to be tilted to optimum angle. Kit contains everything for a complete 88-106 mc band antenna, except guy wires.

Amphenol Dipole Antennas are available now thru your jobber, or get prices and technical data by writing direct.

AMERICAN PHENOLIC CORPORATION
1830 SOUTH 54TH AVENUE • CHICAGO 50, ILLINOIS
COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT • ANTENNAS • RADIO COMPONENTS • PLASTICS FOR ELECTRONICS

COMPLETE KIT
$14.75

NOW YOU TOO CAN BUILD 15 RADIOS

ABSOLUTELY NO KNOWLEDGE OF RADIO NECESSARY

You Need No Additional Parts

The PROGRESSIVE RADIO KIT is THE ONLY COMPLETE KIT. Contains Everything You Need: Instruction Book, Metal Chassis, Tubes, Condensers, Resistors and All Radio Parts.

The 36-Page Book written by Expert Radio Instructors teaches you to build radios in a professional manner. You will learn to wire and solder like an expert. You start with a 1-tube receiver. Before you are done with this kit, you will have built 11 Receivers, 1 Public Address System and 3 Transmitters.

SPECIAL FREE OFFER!

Electrical and Radio Tester with each PROGRESSIVE RADIO KIT

PLUS membership in Progressive Radio Club. Entitles you to free expert advice and consultation service with licensed radio technicians. Complete Kit shipped C.O.D. plus postage, or send check or money order for $14.75 and we will pay postage. Or write for further information.

PROGRESSIVE ELECTRONICS CO., Dept. RN-1
22 Havemeyer St., Brooklyn 11, N. Y.

☐ Check or money order enclosed. Postage Prepaid.
☐ C.O.D. I will pay postage. ☐ Please send me further information.

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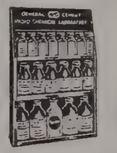
A HANDY NEW TOOL

G-C Radio Hardware


GENERAL CEMENT RADIO CHEMICAL LABORATORY

Inspection Lite
Wire Stripper Kit
Hell Box · Electronic Chemical Lab.

G-C INSPECTION LITE

Just the light for service work, lights up hard-to-see corners. Handy many ways.
No. 705............List $1.50

G-C WIRE STRIPPER KIT

Handy, complete with stripper and 7 different size blades in steel box. Strips wire No. 8 to No. 30.
No. 744-K — Deluxe kit....List $17.00

G-C HELL BOX

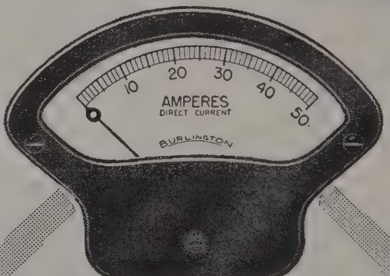
Assortment of thousands of radio parts you use every day, in steel box (screws, washers, nuts, etc.).
No. 6500........................List $4.50

G-C ELECTRONIC CHEMICAL LABORATORY

Ideal for servicemen; 19 bottles & chemicals in heavy (free) steel rack.
No. 998.....List $11.12

Write for the new G-C 147 and Hardware Catalog of over 4000 items
RADIO DIVISION DEPT. H

GENERAL CEMENT Mfg. Co., Rockford, Ill., U.S.A.
Manufacturers of over 3,000 products
Sales offices in principal cities



• *RUGGED*
• *DEPENDABLE*
• *ACCURATE*

Burlington
PANEL
INSTRUMENTS

For utmost reliability—specify and depend upon Burlington Panel Instruments. They are designed, engineered and built to give satisfactory service even under most severe applications—and are fully guaranteed for one year against defects in material or workmanship.

Write today for full details

BURLINGTON INSTRUMENT COMPANY
916 Fourth Stree
BURLINGTON IOWA

extension shaft may be raised or lowered when the button is pressed. The extension shaft locks in any position upon release of the red button. The weight of the microphone will not cause the stand to be lowered past the predetermined point. The shaft may be easily rotated without any adjustment.

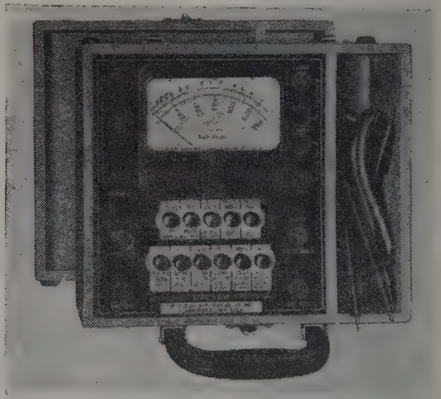
This floor stand has height adjustment from 36" to 65". The leg spread is 17" and the net weight of the unit is 7½ pounds.

For further information write to *Electro-Voice, Inc.,* Buchanan, Michigan. Bulletin No. 134 contains the description of this unit.

NEW MULTI-MASTER

The new Series 858 Multi-Master, manufactured by *Precision Apparatus Co., Inc.* of Elmhurst, Long Island, features push-button operation and provides coverage of 54 a.c. and d.c. ranges.

This unit has a sensitivity of 20,000 ohms-per-volt and has been especially designed for electronic circuit measurements. One row of five buttons selects all functions such as volts, ohms, mils, decibels, amperes, and microamperes. The other row of six buttons selects all ranges.



The Series 858 is available in two models, the 858-P for portable operation while the 858-L is designed for laboratory use.

For additional information on this new Series 858 test unit write direct to *Precision Apparatus Co., Inc.,* 92-27 Horace Harding Blvd., Elmhurst, L. I., New York.

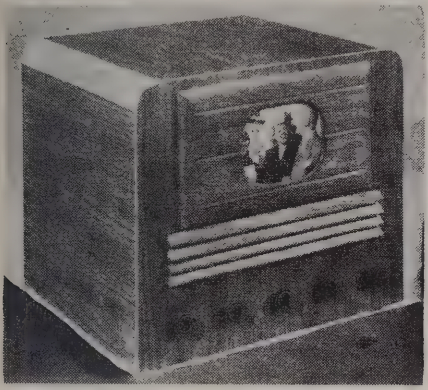
TELEVISION RECEIVER

Dynamic Television Associates, Inc. is offering a complete television kit which has been designed for construction by amateurs, experimenters, students, and servicemen.

Available in either the Model TU7A standard unit or the deluxe Model TU7DL the kit is furnished complete with all tubes including a *DuMont* 7" cathode-ray tube. The chassis is completely drilled and punched and no machine work is required. Construction diagrams are furnished.

Features of the unit include a 3.5 mc. bandwidth, 25.75 mc. trap-tuned, high gain video i.f. transformers, FM sound circuit, three stages of video i.f. amplification, and two stages of video amplification.

Additional details and prices on these kits may be secured by writing *Dynamic Television Associates Inc.,* 155 Prince St., Brooklyn, N. Y.



IRC CONTROL CABINET

A new popularly-priced kit of controls, the Junior Control Cabinet, has been introduced by *International Resistance Co.,* of Philadelphia.

The kit contains an active assortment of nine ½, 1, and 2 megohm controls, plus four switches and four special shafts.

Distribution is currently being made through *IRC* distributors, or *International Resistance Co.,* 401 N. Broad Street, Philadelphia, Pa., will supply additional details on request. —30—

Learn as You Build

(Continued from page 42)

the paper condensers sorted from the ceramics, the micas, and electrolytics, and the several sizes of resistors sorted according to their wattage values.

If available, adhesive tape identification symbols can be affixed to the various parts as indicated in the parts list. When adhesive symbols are not available, hand lettering will, of course, suffice.

The markings used for identification, it will be noted, are the same as those used in the schematic diagram. This makes possible either construction from the diagram or an assembly based on production line procedure in which each operation is processed through the use of previously identified parts.

The resistors, after being separated according to wattage rating, should then be subdivided according to the first significant color band, which is the one farthest away from the silver or gold tolerance band. When all are accounted for, the "R" numbers can be affixed and the resistors arranged numerically by racking them in a strip of corrugated board. This will facilitate locating any resistor quickly during construction and it will be found to be most convenient, even to experienced constructors.

Starting with the bare chassis, the sockets are the first units to be assembled on it and right at the start

SELECTED SURPLUS—"THE CREAM OF THE CROP"
NEW CONDITION . . . NONE FINER AVAILABLE ANYWHERE

COLLINS ART-13 TRANSMITTER

We offer a small lot of Collins ART-13 Transmitters at the lowest price at which this excellent equipment has ever been sold. The frequency range is 2,000-18,100 KC. in ten channels, voice, CW or MCW. Included with each set are the following. 1 28-volt dynamotor, 1 Pilot's Control Unit and the necessary connectors, as illustrated. Output power is 100 watts normal at 90% modulation. This equipment is in PERFECT condition, having been removed from naval aircraft, and much of it has had "test service" only. Appearance is like new. Here is the buy of a lifetime.

ONLY
$119.50
WITH TUBES

Send Your Order by Telegraph or Air-Mail

SCR-274-N COMMAND SET. 2 TRANSMITTERS & 3 RECEIVERS
ALSO INCLUDES MODULATOR

• 6 Units, as illustrated, 4-5.3mc BC-457A and 5.3-7mc BC-458A transmitters, 1 each, 3-6mc BC454A, 190-550kc BC-453A, 6-9.1mc BC-455A Receivers, 1 each. Also BC-456A Modulator Unit. Our price of $34.95 includes all of the tubes required, as well as four dynamotors, control box and Antenna Tuning Unit with 0-10 Meter and 50uuf. vacuum condenser.

ORIGINAL COST OVER $600.00. TUBES ALONE WORTH OVER $40.00
OUR PRICE FOR THE COMPLETE COMBINATION..............ONLY $34.95

Units also sold individually, as follows:
BC-453B Rcvr. 190-550Kc, with tubes, $8.95. BC-454 Rcvr. 3-6 Mc. with tubes, $5.95. BC-455 Rcvr. 6-9 Mc. with tubes, $5.95.
BC-457A Xmtr. 4-5.5 Mc, with 4600 Kc Xtl & Tubes $9.95.
BC-458A Xmtr. 5.7-7 Mc, with 6200 Kc Xtl & Tubes $9.95.
BOTH Xmtrs and shock mounting rack $18.95. Dynamotors, 28v for Rcvr. only $1.95 ea. Current Meter 0-10 (2") $1.95.

HEAVY-DUTY ALL-PURPOSE 6L6 PUSH-PULL AMPLIFIER

SUITABLE FOR—Wired Music, Coin Phonographs, Home Phonographs, Amusement Parks, Carnivals, Sound Trucks, Schools & Churches, Public Address, Etc.

LICENSED BY WESTERN ELECTRIC FOR USE IN P. A. SYSTEMS AND PHONOGRAPHS

• These brand new Amplifiers in factory-sealed cartons are a Manufacturer's over-run. JUST COMPLETED! Parts alone cost more than full price of the amplifier. Standard RCA tubes (2-6L6, 1-6SL7, 1-6C5, 1-5U4G). Input for crystal or magnetic pickup, 600-ohm telephone line, and microphone. Separate Bass and Treble controls. Volume control. Output for standard 8-ohm speakers. Relay operated COUNTER (10,000 count) for coin-machine plays. Heavy duty power supply. Gray crackled case with lid. 10"x17"x9". A big, husky job. 15 watts output 110-120 volt 60 cycle AC operation. Complete with all tubes and wiring diagrams. This is one of the greatest bargains ever offered.

ONLY
$49.50 NET
List $147.50

SMALL PRECISION LATHE

110-V. A.C.
WITH
MOTOR
$58.50 List

• NOT SURPLUS—but a brand new post-war product. A small lathe for radio shops, jewelers, laboratories, dentists, hobbycrafters, model makers, machine shops, schools, etc. Automatic Feed. Work capacity 3" between centers. Swing over bed 2". Constructed of steel and cast iron. Accurately machined and finished. Fan-Cooled Motor mounted inside the base. Complete with 1¼" face plate, 2 lathe centers, tool post and rocker. 4-jaw chuck available at $11.50 additional. Drill chuck $5.50 additional. Orders filled in rotation. Deliveries now.

QUANTITY DISCOUNTS TO DEALERS

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a very important thing to watch is the proper orientation of each socket. Any mistake in the positioning of the key of the octals or the blank section of the seven contact miniature sockets will cause undue confusion and possibly poor results later.

Sockets having a tin plated mounting ring below the chassis are ideal for the frequent ground connections used in wiring. If no such ring is used, short ground lugs will be required at each socket mounting bolt.

The terminal strips can be bolted or riveted in place as indicated in the picture. Secure grounding of the mounting lugs is important for they will serve as ground connections for numerous circuits.

The power transformer should be mounted next, with its 110 volt primary leads brought through the rear clearance hole. Since the power transformer is the same height as the front panel, it serves as a convenient stand while the chassis is inverted for assembly.

While the can type electrolytic condenser can be mounted right after the power transformer is in place, the filter choke should be withheld until wiring is completed beneath it. The two small audio type blocking oscillator transformers, T_4, and T_5, can next be mounted, taking care that the low frequency unit, T_5, is nearest the front of the chassis and next to V_{13} socket.

After adding ground straps to the controls requiring them, as indicated in the schematic, all but the audio volume control may be mounted in place. Care should be taken to get the correct value control in its respective position and here a close check on the photograph will reveal the control number as well as the position of its terminals. The audio control (R_{68}) with the power switch attached, should be treated as a subassembly by mounting C_{83} across its outside terminals and attaching C_{70} before the control is installed.

While the oscillator tuning condenser C_{13} can be mounted with the first group of controls, it will be found desirable to make a subassembly of the channel switch and let the mounting wait until one of the last operations.

There are three different kinds of intermediate frequency transformers, so they must be placed as identified. The first i.f. transformer, T_1, follows the mixer and through mutual coupling supplies the 21.25 mc. signal for the sound channel. The secondary of this transformer is a trap circuit and as such keeps the sound i.f. signal out of the picture i.f. channel. In keeping with the need for short lead lengths in these circuits, it is important that terminal *"A"* of this transformer face the back of the chassis and terminal *"D"* face the front.

The second sound i.f. transformer, T_2, is similarly mounted between sockets V_8 and V_9.

After V_9, the discriminator transformer, T_3, must be mounted with its

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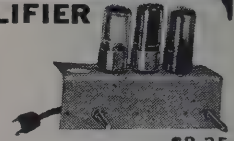

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terminal "*A*" toward the back of the chassis and "*E*" towards the front.

The three identical picture i.f. inductances should be mounted so that the lead from the bottom end of the winding on the first two (L_3, L_4) faces the front of the chassis and for L_5, to the rear of the chassis.

Wiring Procedure

From the pictures and the associated data following the mounting of basic components, it is apparent that the socket grounds, a group of bypass condensers and independent resistors are wired in place to form the first of a number of layers used in the construction procedure.

Interconnecting wires and subsequent parts are named in an order which permits a gradual folding together of the second and third layers in actual construction. In following this sequence, therefore, no difficulty should be experienced from overlapping of snugly placed parts.

Since short leads are essential to good high frequency performance it is advisable to copy the photographs as closely as possible and thus take full advantage of the careful planning necessary for the successful mounting of critically placed parts.

Where heat is to be dissipated from certain resistors, it will be noted that they are allowed a fair amount of clearance from neighboring parts. This accounts for the 1 watt screen resistors being mounted in the final layer of construction and their being kept about one inch from the chassis. Warmed air rising from the larger resistors will naturally circulate towards the ventilation holes provided in the top of the chassis.

In order to take full advantage of the layer construction, a definite sequence of mounting wired parts must be followed. The first step is to ground all center eyelets of the miniature sockets with tinned copper wire. While doing this the grounded socket terminals can also be included and a check of the schematic will indicate which terminals require grounding. All number 3 miniature socket terminals can be connected together with an insulated green wire for filament current distribution.

We are now ready to mount the ceramic bypass condensers, which should be laid close to the chassis and exactly as shown in the picture. Use the following order: C_{20}, C_{16}, C_{23}, C_{27}, C_{31}, C_{41}, C_{47}. The next few are to be mounted on a 60 degree angle as shown and they are: C_{15}, C_{22}, C_{26}, C_{30}, C_{46} and a combination, C_{39} and C_{40}.

The first group of resistors, some mounted on a 45 degree angle and some mounted vertically follow: R_1, R_7, R_{16}, R_{27}, R_{31}.

Mount R_{11} between pin 2 of socket V_4 and the fourth point from the front on terminal strip 2. A yellow wire connects the latter point with the contrast control.

Next wire a portion of the audio system: R_{69}, R_{70}, C_{72}, R_{71} and C_{73}. Also

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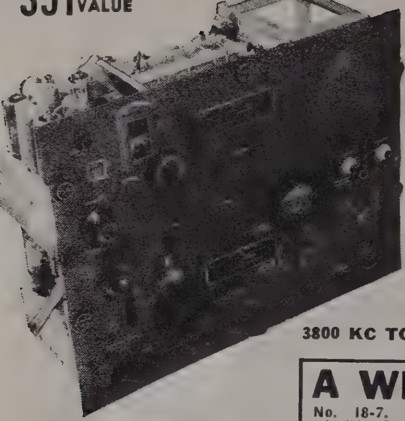

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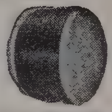

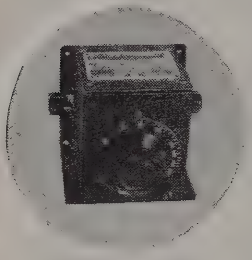

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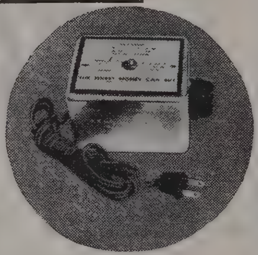

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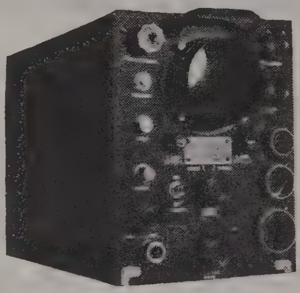

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following that: R_4, R_2 and a lead from pin 6 on V_{17} to C_{71}.

We are now ready to connect the i.f. transformers and add associated resistors and condensers as follows: C_{42}, C_{45}, R_{30}, C_{48} and C_{52}.

Approaching the second detector and the synchronizing circuits add: R_{22}, R_{20}, R_{21}, the peaking coil, (L_6), R_{23}, R_{24}, C_{35}, R_{42}, R_{37}, C_{12}, R_{39}, R_{48}, C_{58} and C_{56}.

Connect the four leads, by colors indicated on the schematic, from each of the blocking oscillator transformers T_4 and T_5. After that mount more parts in those circuits, namely: C_{62}, R_{55}, R_{53} and R_{66}.

The speaker and output transformers can next be mounted and wired in place. After that the two high voltage condensers, C_{66}, C_{67}, can be bolted down and wired also.

By this time the leads from both the cathode-ray tube socket and the power transformer can be dressed into place and connected. After that mount the filter choke CH_1 (labeled L_7 in the photograph) and the power cord but *do not apply power* until the set is completed.

The rest of the assembly is straightforward except that the connections for coils L_3, L_4 and L_5 should precede the installation of the coupling condensers C_{25}, C_{29}, C_{33} and the screen resistors R_8, R_{13} and R_{17}, which, incidentally, should clear the chassis by about an inch.

Considerable care should be exercised in placing the oscillator coil. It must be mounted on the lugs of C_{13}, the tuning condenser, exactly as shown.

The antenna coil is mounted by its leads to the number one terminal of socket V_2 and an immediate ground point at the base of that socket.

Mixer coupling is affected by twisting the insulated grid wires of V_1 and V_2 together.

If the receiver is to be used in an area served by channels 1, 5 or 6 the following additional condensers, *not mentioned in the parts list,* will enable it to tune to these channels.

Channel I—add C_1 (27 μμfd.) between first terminal and ground on S_{1A}.

Channel I—add C_7 (12 μμfd.) between first terminal and ground on S_{1B}.

Channels V and VI—add C_5 (3.3 μμfd.) between fifth terminal and ground on S_{1A}. No additional condenser is required on the fifth terminal of S_{1B}.

Inspection and Test

Before turning on a newly constructed receiver, it is wise to give it a thorough visual inspection and then to test the step-by-step operation of various circuits to assure safe over-all performance. *DO NOT APPLY POWER DURING VISUAL INSPECTION.*

Connections for each part, each socket terminal, and all wire colors must be verified for compliance with the circuit diagram or construction photos.

The high voltage circuit including power transformer leads, rectifier tube socket connections, high voltage condensers, brightness and focusing controls as well as the series resistors in that circuit, must all have at least ⅛ of an inch clearance between uninsulated metal parts and ground.

After completing the visual inspection it is advisable to make a check of the resistance to ground of both of the power supply circuits. The filament contact of the low voltage rectifier and the plate connections of the high voltage rectifier should both show a high resistance.

The power line plug connections should show an open circuit to ground.

With the power switch on and with a d.c. ohmmeter across the power plug terminals, a reading of three ohms should be indicated.

The next step is to check the type number of each tube to be sure that it is in its proper place.

The cathode-ray tube can be mounted in position with the base well seated in its socket but *both rectifier tubes should be removed from the set for the initial trial under power.*

With the set right side up, plug the power cord into an 110 volt, 60 cycle a.c. outlet and then turn on the switch. Note first the orange color glow of the filaments in the miniature tubes and near the base of the cathode-ray tube.

When the filaments are all known to light satisfactorily, (by heat emission in cases where no light is visible) the next step is to plug the high voltage rectifier tube into its socket. This should be done with the power turned *off*.

Within about 15 seconds after turning the power on again, a spot of light should appear on the cathode-ray tube screen. If it does not, observe first the plates in the rectifier tube for a possible dull red glow. This will indicate trouble in the high voltage circuit and is reason enough to disconnect the power source at once and proceed with a check-up on the entire high voltage circuit. *Be sure to short circuit the high voltage filter condenser* before making other tests or touching any part of the wiring.

Should the spot fail to appear with the rectifier tube acting normally, adjustment of the *"Brightness"* control should follow. It is possible that the spot could be off screen and for this reason both *"Vertical"* and *"Horizontal* Centering" controls should be turned through their range.

Operation of the *"Focus"* control is the next thing to check and this should result in variation of the spot size. Do not allow the spot to remain on or in one position longer than a few seconds as it may burn the screen material and result in permanently poor illumination at that point.

If everything is performing well so far, then the next step is in order, and the low voltage rectifier tube can be inserted in its socket. Like the

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other rectifier, it too must be watched for red glow on the plates, which is a sign of too much current drain. As the rectifier warms up and the deflection oscillators start to function it will be noticed that the light spot on the screen will suddenly swing into motion producing an over-all illumination of the screen area or some rectangular part thereof. It may be necessary to increase the brilliance to observe this change.

Alignment

The following equipment is required for alignment: 1. A radio frequency test oscillator or signal generator with a range up to at least 30 megacycles; 2. A high resistance voltmeter, preferably of the vacuum tube type with a low range scale of at least five volts; 3. Insulated alignment screw driver.

Signals can be injected into the #1 grid of the mixer tube V_2 by clipping on to the station selector switch-arm to grid lead and grounding the test oscillator at the front of the chassis.

For picture i.f. alignment the meter should be connected to the video detector output, pin #7 on V_6 and set to read negative voltage. The contrast control must be turned to maximum output position during the following procedure.

With a 23.75 mc. amplitude modulated signal applied to the mixer grid, introduce enough signal to obtain a fair meter deflection. The mixer plate tuning adjustment (T_1 upper screw) should then be set to produce a maximum output indication. The same frequency is likewise used in tuning the last picture i.f. coil, L_5.

After these two adjustments are completed the test oscillator should be reset to produce 25 mc. so that frequency can be used to set the next to the last video i.f. coil, L_4, for maximum output.

The test oscillator should again be reset, this time to supply a 25.75 mc. signal which is used in adjusting the remaining picture coil L_3, to maximum output. Any sudden full scale deflection of the meter is a pretty sure indication of oscillation within the i.f. channel and is often due to coupling of attached test leads. Rearrangement of the leads or slight detuning of the affected stage will help to overcome this condition.

With a modulated signal applied, a horizontal bar pattern will be shown on the cathode-ray screen, if the video amplifier stage is working properly. This serves as a test for the video amplifier and for the vertical synchronizing circuit inasmuch as the bars will remain fixed by virtue of synchronizing control.

A crude check for bandwidth response can be made by varying the test oscillator through the region of 20 to 27 mc. while observing the bar intensity or the meter deflection.

Applying a 21.25 mc. amplitude modulated signal, adjust the sound i.f. transformer cores (T_3, T_2, T_1 lower) for maximum output from the

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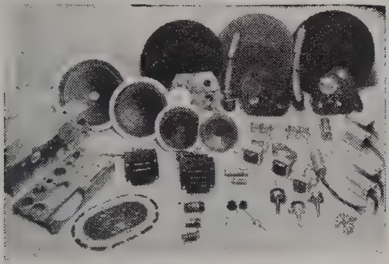

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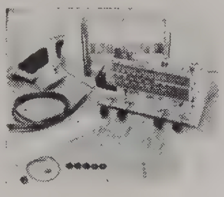

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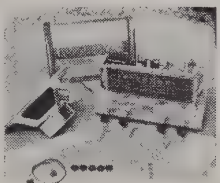

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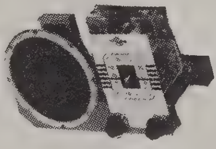

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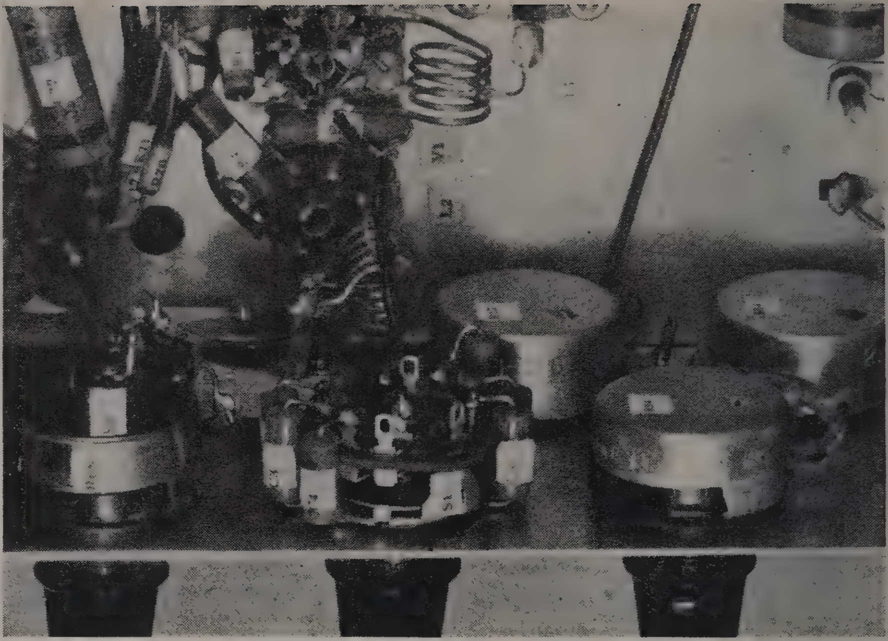

Enlarged view shows position of coils L_1 and L_2

speaker. This adjustment should be repeated several times, each time with a lower input signal.

After sharp and sensitive tuning has thus been accomplished, connect the voltmeter across the two discriminator output resistors (R_{34}, R_{35}) and with an unmodulated signal strong enough to show a fair meter deflection, readjust the discriminator coil core (T_3, lower screw) to a point where the meter swings suddenly through zero and indicates reverse polarity. When this point is found, carefully conclude the adjustment by setting the core screw to make the meter indicate zero between positive and negative swings.

After completing all i.f. adjustments, seal the core screws in place with a little plastic cement.

The receiver can then be tried for television reception. Attach the antenna and set the bandswitch to the channel of a station known to be on the air at the time. With *"Contrast"* and *"Sound Volume"* controls at maximum clockwise position, adjust the oscillator fine tuning for reception. As the sound tuning is rather sharp, slow careful adjustment should be employed to find the best point for suitable tone quality.

If no signal is received the r.f. oscillator's (V_1) d.c. grid voltage should be tested to be sure that the usual negative-to-ground voltage is present. This may average between -7 to -20 volts and its absence is a sure sign that the oscillator is not operating. The cause must be corrected before superheterodyning can be expected.

It should be remembered that the incoming signal may be received on the wrong channel-switch position, until the oscillator coil itself is adjusted.

The use of a signal generator covering the u.h.f. range or the second and third harmonics of a test oscillator whose maximum fundamental signal is 30 mc. will be of considerable help in determining the coil adjustments required.

If channel three signals come in on channel two position of the selector switch, for instance, this indicates that the oscillator is operating at too high a frequency and that its inductance must be increased. With the set turned *off*, the inductance of the oscillator coil can be increased by compressing its spring-like windings between the thumb and forefinger. Close examination should follow to determine that none of the individual turns are touching each other or any nearby points.

After the tuning is properly adjusted and the set connected to its own antenna, the antenna coil L_1 can also be compressed or expanded to improve reception. Connecting the voltmeter to the detector output as for picture i.f. alignment, the incoming signal should be tuned to maximum with the tuning control. The antenna coil can then also be adjusted for maximum signal indication on the meter.

Servicing Methods

One of the prime considerations in the design of this miniature television receiver was simplicity. This, together with the use of modern miniature tubes and a stagger tuned picture i.f. channel, makes servicing relatively easy.

Standard signal tracing procedure can be employed throughout the receiver or as an alternative, *signal injection* is equally effective.

To test the two audio stages an a.f. signal, for example a 400 cycle tone, can be injected into the reverse succession of grids and plates, working backwards from the speaker to the discriminator.

The video amplifier can be checked with the same a.f. signal working back from the cathode-ray tube grid to the picture detector. *Because of high voltage, a careful analysis of all points in the cathode-ray tube circuit should be made and tests conducted with due regard to safety requirements.*

When an audio signal is applied to the video input, horizontal lines will appear on the *CR* tube screen provided, of course, that the sweep circuits are functioning.

Failure of a sweep deflection can be traced forward between the blocking tube oscillator and the deflection plates. If no signal is obtained from an oscillator a confirming check can be made by testing for the presence of a negative voltage at its grid. If none is present, the oscillator is definitely defective.

To test either the picture i.f. or the sound i.f. amplifiers, signals of the proper frequency can be injected in reverse order between the detector (or discriminator) and the mixer tube. Any failure in the path of the signal should be investigated by testing the supporting "B plus" and bias voltages and possibly rechecking the alignment.

Since information has already been given on the antenna and oscillator circuits, their servicing can be considered in the light of standard superheterodyne practice.

As a final note, it will probably be found well worthwhile for the constructor to spend as much time familiarizing himself with the above tests as he spends on actual wiring, for that is an ideal way to achieve a basic training in the fundamental performance of his television receiver. Knowing one receiver well will certainly help in the mastery of others.

—30—

Max Joseph Bonsted, W2EQ of Audubon, New Jersey, recently relayed the instructions of Dr. Ralph W. Davis (left), Chief Surgeon at Audubon Hospital, over 6000 miles of ether to tiny Palmyra Island in the Pacific where an unidentified soldier was dying of injuries received in a plane crash. Following the doctor's instructions, men treating the soldier reported that he seemed to be improving. With no physicians available on Palmyra Island, a government weather observer used his ham station to contact Bonsted, who called in Dr. Davis to complete this transoceanic medical consultation.

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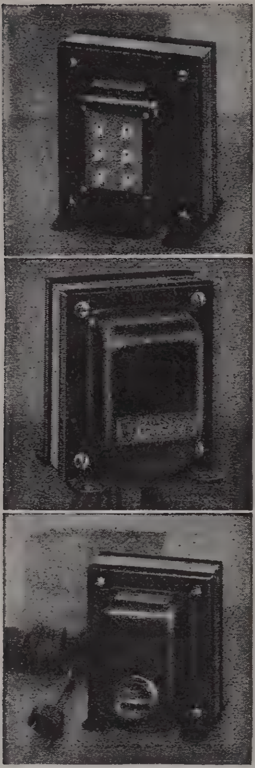

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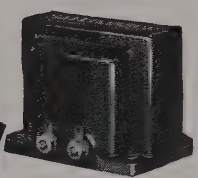

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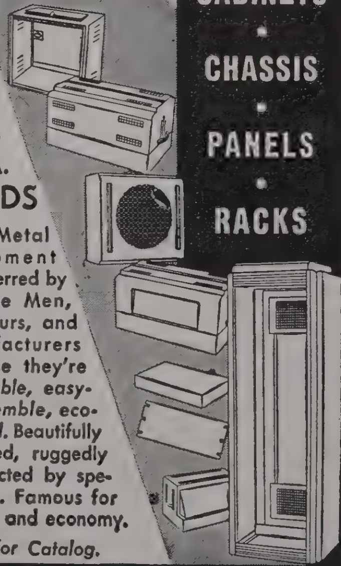

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2 Meter Receiver

(Continued from page 59)

They are somewhat overcoupled, a desirable feature where three stages are going to be used, and are double tuned by means of adjustable iron cores. The fixed capacity across each winding is 50 μμfd. which results in a fairly high "C." If it is not possible to obtain similar transformers, standard FM i.f.'s of either the 4.3 or 5 mc. type may be used.

In designing the front end of such a receiver the problems are more mechanical than they are electrical. The diagram reveals nothing unusual in this section except perhaps the method of coupling between the sections. (Coupling between the oscillator and mixer was found to be best when there was no intentional coupling and stray fields alone were used.) This takes care of the problem of interaction between the oscillator and mixer circuits and also reduces the amount of distributed capacity across both tuned circuits.

The mixer grid is capacity coupled to the plate of the 6AK5 by means of a choke coil which resonates just outside the band by means of its own distributed capacity plus that of the 6AK5. The coupling capacitor is very loosely coupled to the low end of the 9001 grid coil by tapping on only a short distance up from the bottom. This provides a good impedance match between the two circuits and prevents loading and broadening of the 9001 grid circuit. This grid circuit tunes critically and provides a surprisingly high order of gain and selectivity. By keeping the distributed capacity in the circuit at a very low point a fairly large amount of inductance can be built into the coils, thus increasing the gain.

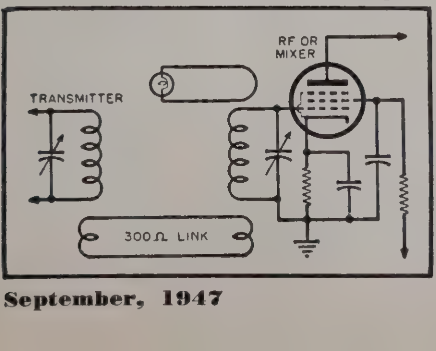
The 6AK5 r.f. stage provides a gain of 3 to 4 and is unquestionably worth the trouble of including it in the receiver. The antenna is coupled into the grid of the 6AK5 by the same low impedance method. One side of the 300 ohm line is grounded to the ground point of the tuned circuit and the other side is connected a short distance away on the coil, between a quarter and a half turn up from the start. This method of coupling a balanced line does cause some unbalance and it would be preferable to couple by means of a two turn link around the lower end of L_1. The tuning of the 6AK5 grid circuit is not quite as critical as that of the 9001. It is a true preselector, however, and cannot be set in the middle of the band and work efficiently over the whole band. Tracking of this stage with the mixer and oscillator stages is accompanied by a noticeable increase in background noise. This fact shows that a high degree of "Q" has been obtained in the tuned circuits and offers a convenient method of finally adjusting the ganging of this stage.

The mechanical arrangement of the front end has a great deal to do with its final success. From the illustrations it may be seen that each stage, the oscillator, mixer, and r.f. amplifier is separately assembled on a sheet of polystyrene ⅛ x 2 x 2½ inches. The tube socket, tuning condenser, coil, and all other resistors and condensers are assembled complete on these small panels before putting them together into the final assembly. Polystyrene rod, ½ inch diameter, is drilled and tapped on each end and 6-32 machine screw studs are inserted so that they may act as spacers between the sections and can be assembled by screwing the stud from one into the threaded end of another through holes in the panel assemblies. A small vertical shield, 3 x 4 inches, is provided between the mixer and r.f. stages. In the illustration, the r.f. stage is closest to the panel, the mixer is behind it, and the oscillator is at the rear of the chassis.

When the shaft couplings have been added the entire assembly is complete in itself and can be ganged and pretested before assembling into the receiver. Four spade bolts, two at the front and two at the rear, project downward from the front end assembly and permit it to be easily fastened in place on the chassis.

Probably the most troublesome part of building any superhet receiver, and the obstacle that keeps more hams from trying it, is the problem of getting it lined up properly, particularly in the absence of elaborate test equipment. A method will be described by which a receiver such as this one can be aligned with very little equipment. In fact, this was the method by which the receiver pictured was actually first put into operation. One of the few absolutely essential pieces of equipment is some sort of a signal generator for setting the i.f. transformers. This can be a very inexpensive service type oscillator or a homemade affair with some sort of tone modulation added. The accuracy need only be within ten per-cent on frequency and no output calibration is necessary. Begin by lining up the i.f.'s at whatever frequency they are to be operated. In the case of the receiver being described here, the frequency was 6 megacycles. Keep the input coupling between the generator and the first transformer just as loose as possible and still maintain an audible signal. This will prevent double peaking of the i.f. transformers and will also show up any tendency on the

Circuit that was used to preset coils and condensers to proper frequency.



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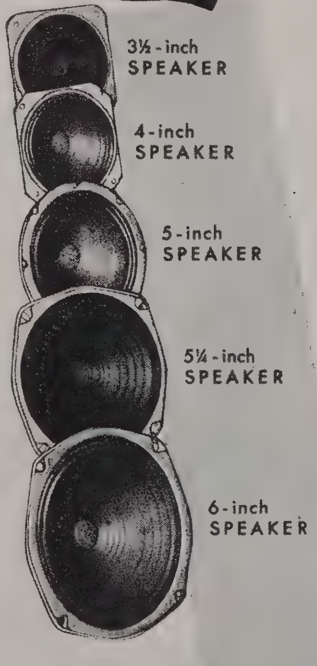

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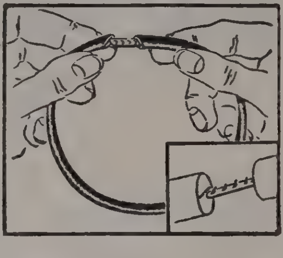

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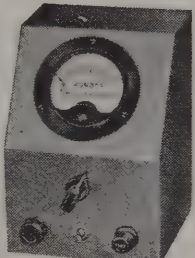

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part of the i.f.s to spill over or oscillate. When all of the transformers have been aligned there should be a noticeable background noise in the speaker when the gain control is wide open. This should be noticeable but not over loud. Too much rush noise may indicate that the i.f. strip is oscillating and additional shielding or bypassing may be required. It may be well to point out here that the .01 μfd. condensers shown bypassing the ungrounded side of the filament at each of the 6AC7 sockets were found to be very necessary to prevent oscillation. If oscillation still persists after using the values shown, try adding a .001 μfd. mica condenser in parallel with the .01 μfd. condenser already there. Also, a 1 μfd. condenser on the filament supply bus under the chassis may help. Keep all leads very short. Bring all grounds associated with one stage to one point and ground absolutely nothing else at that same point. Keep the placement of parts under the small chassis as symmetrical and neat as possible, making sure that each stage is wired exactly the same as the others. By taking these precautions seriously, any number of these i.f. strips can be built and they will all work alike. Three have been built so far and no trouble has been experienced with instability.

In the event that other transformers are used (other than those shown in the diagrams) it may be necessary to increase the bias on the 6AC7's or possibly to add some resistance loading across a few of the transformer windings to keep them from "taking off." If the i.f.s are stable, bringing the hand near the input lead should be sufficient to bring in signals with good volume depending on the i.f. frequency used. In the case of the receiver being discussed, airplane signals could be heard all over the house with only the three inch piece of wire sticking out of the input transformer. If signals can be heard without whistles or squeals this is further indication that the i.f. stages are stable and are ready to be connected to the mixer stage.

Before connecting the i.f. channel to the mixer plate, however, a great deal of time can be saved if it can be determined whether the mixer grid is tuning somewhere in the 144-148 megacycle band. If the builder has a transmitter already on this band or knows of someone who has, the problem of aligning these stages before putting them into the receiver is very simple. Disassemble the three front end sections from each other so that the mixer stage can be handled by itself. With all of the circuit components wired in, the tube in the socket, without the filament or high voltage leads connected, couple the tuned circuit of the mixer to the plate tank of the transmitter. Turn on the transmitter without an antenna and connect a piece of 300 ohm line from the transmitter pickup coil to a small one-turn coil which is coupled to one end of the mixer coil. At the other end of the mixer coil, couple a small one-turn coil with a flashlight bulb in series with it. By adjusting the mixer coil until the bulb lights with the tuning condenser some where near the middle of the range, the presetting of this stage can be accomplished. The r.f. amplifier is preset in much the same manner. When both of these stages have been adjusted they are ready to be reassembled and should be handled with care to prevent moving or changing any of the circuit components.

The oscillator must next be set on the band and this can be done in several ways. Perhaps the easiest way is to use a superregen receiver which tunes to at least 142 megacycles and to set the oscillator stage so that the superregen receiver blocks at this point when the oscillator plates are about ½ to ⅔ of the way out. The oscillator in this case will be working below the incoming signal, something which will aid stability and give a little more bandspread. By setting the oscillator at 142 megacycles it should be at the correct setting to receive signals around 148 megacycles provided the i.f. frequency is 6 megacycles.

After these preliminary adjustments have been made, the entire front end should be assembled and wired into the set. With voltages applied, the antenna should first be coupled into the mixer stage by means of a single turn coil held close to the grid end of the mixer coil. The mixer tuning condenser should be set at about ½ rotation and held there while the oscillator tuning condenser is rotated in and out until a signal is heard. Then tune the mixer stage until the signal is loudest. Note the relative positions of the two tuning condensers. If they are at widely different settings, adjust one or both coils until the two condensers tune in a signal at approximately the same relative setting. When this has been done, the ganging of these two stages is completed and the antenna may be coupled into the r.f. stage in the manner shown in the diagram. The r.f. stage is adjusted to track with the other two stages in the manner just described. When completed, the couplings between the three condensers can be tightened and the receiver is finished.

The presetting of the inductances in the manner described above should place the tuned circuits near enough to the correct value so that signals can be heard almost immediately with a little tuning around. This will save hours or even weeks of searching for the band. It should be pointed out that very small changes in inductance or capacity will make correspondingly large changes in frequency and therefore the builder is cautioned to make changes slowly and only a little at a time. Once the band is located no changes should be made in the oscillator circuit until after the mixer and r.f. stages have been completely aligned and adjusted and no further improvements can be made in them. Then, if desired, the tap on the oscillator coil can be adjusted for optimum oscillator amplitude. This can be de-

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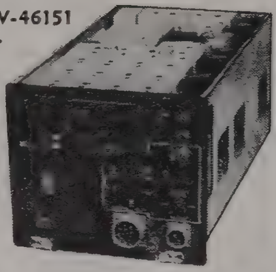

Four bands, including broadcast (195-9,050 KC). Circuit is six-tube superheterodyne with mechanical band change or remote operated electrical band change. Remote band change and tuning controls included, making this set readily adaptable to mobile ham use. Powered from self-contained 24 V. DC dynamotor.
The sets are complete with tubes, mounting rack and remote controls.

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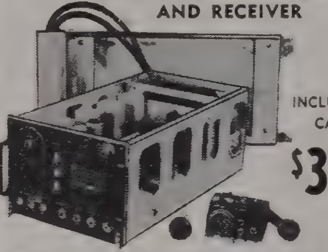

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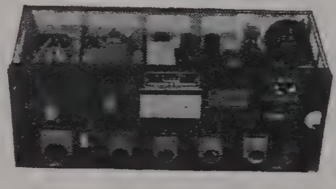

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A complete 460 mc. radio receiver and transmitter which can be converted for ham or commercial use. Tubes used and included: 4-12SH7, 3-12SJ7, 2-6H6, 1-VR150, 2-955, 2-9004. Other components such as relays, 24 V dynamotor, transformers, pots, condensers, etc., make this a buy on which you can not go wrong. Complete as shown in aluminum case 18"x7"x7¼
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termined by the signal-to-noise ratio as well as the general loudness of the signals received. Changing the tap will shift the oscillator frequency and therefore large changes should not be made at one time.

If a direct reading dial is to be made it is well to keep in mind that some drift can be expected up to 15 minutes after turning on the receiver so it is a good idea to allow it to become good and warm before attempting to calibrate the dial. If this precaution is taken, a perfect calibration can be obtained and it will remain accurate as long as no changes are made in the receiver. Antenna changes have no effect upon it, naturally.

—30—

Vibrator Tester

(*Continued from page* 48)

There is nothing complicated about the vibrator tester. Nevertheless, it is a useful service instrument. One thing that is desired in a test is to try the vibrator for its ability to start at voltages likely to be encountered in actual service.

In order to accommodate the large variety of vibrators having different prong arrangements the tester would need at least seven sockets. However, the number of sockets to be included is a matter of personal choice. The diagram shows only two sockets. Additional ones may be used to take other vibrators if desired. Due to the fact that most of the sockets needed are special and hard to obtain, it is much easier to use just the two sockets shown. These two sockets will test a high percentage of all vibrators encountered. To take care of the remainder, two cables, with two wires each, and a single wire are brought out. Alligator clips with rubber insulators are put on the ends of each cable wire. One of the cables should be designated as the primary and the other as the secondary. The single wire is the common negative. Black rubber insulators may be used on the primary cable and red on the secondary. The common clip is left bare.

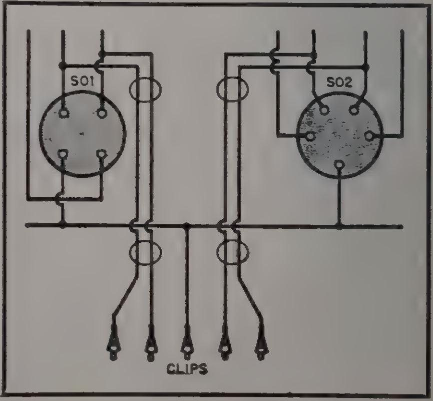
Inside the tester the cable marked *"Primary"* is connected to the top two contacts of the four-prong socket and the cable marked *"Secondary"* is connected to the top two contacts of the five-prong socket. The single wire is connected to the common negative lead, the one that connects to both sockets, the meter, the potentiometer, the battery, load resistor, and the filter condenser. Fig. 2 shows how the five wires are to be connected.

To test a vibrator using these wires it is only necessary to refer to the vibrator connection circuits in a service encyclopedia. It is easy to connect the wires to the prongs. For a non-synchronous vibrator only the primary cable and the common wire are needed. The common wire is connected to the reed prong and the cable wires are connected to the contact prongs. The switch on the tester should be in the position so that the output from the secondary of the transformer passes through the rectifier tube. For testing a synchronous vibrator the common wire is connected to the reed prong, the primary cable wires are connected to the primary contact prongs, and the secondary cable wires are connected to the secondary contact prongs. The synchronous interrupter switch should be thrown to the position for synchronous vibrators. The polarity reversing switch should also be thrown to the correct position.

Internal view of vibrator tester. All parts are mounted direct to front panel.

To test any vibrator, first place it in the proper socket or turn it upside down and connect it into the circuit with the cables as explained above. The voltmeter switch is then thrown to the input position. The synchronous interrupter switch is thrown to the proper position, depending on whether the vibrator is synchronous or non-synchronous. The polarity reversing switch is used only when testing synchronous vibrators. It is then switched to the position that gives a positive voltage on the side of the load resistor that connects to the cathode of the rectifier tube. The position of this switch depends upon the arrangement of the secondary contacts in the vibrator. It is important that the correct polarity be obtained before the tester is allowed to remain on because reversed polarity will damage the electrolytic filter condenser if allowed on any length of time. The push switch that connects

Fig. 2. Wiring diagram shows method used to connect, externally, vibrators with base connections other than those provided on the original testing panel.



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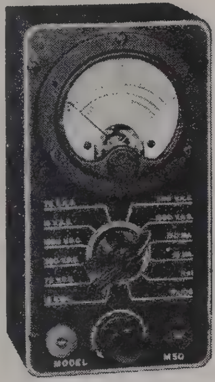

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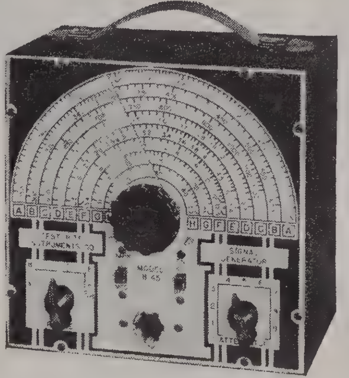

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  2 D.C. CURRENT RANGES: 0-15/150 MA.
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- Attractive modern black and white panel.
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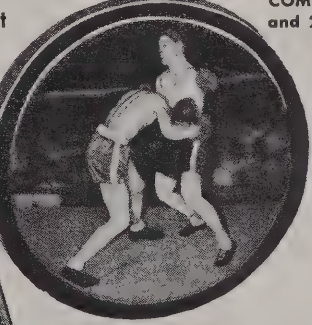

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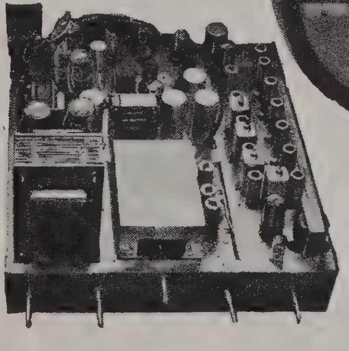

FRONT END

Will handle 13 television channels. It is so flexible that any number of channels from 1 to 13 can be used. This allows a start with the channels now in use 2-4-5-7-9-11-13 and then install the others as desired for a slight additional cost.

TUBES

6AK6—Tuned R.F. Amplifier
6AK5—Mixer
6C4 —Oscillator

ANTENNA INPUT

Balanced 300 ohm line.

Aligned and tested, ready to use when delivered. Merely connect B plus, filament and output I.F. leads to the television chassis. It is not necessary to make any R.F. alignments.

I. F. VIDEO & SOUND STRIP

(PATENTS PENDING)

- 1. PICTURE I.F. STAGES:
  Five I.F. Picture Stages of Amplification.
- 2. SOUND I.F. STAGES:
  Two I.F. Stages with Limiter & Discriminator.
- 3. VIDEO STAGES:
  Two Video Stages of Amplification with a flat response of 4.5 M.C.
- 4. ONE D.C. RESTORER.
- 5. TUBES:

Five 6J6 — Picture I.F. Amplifier
One 6J6 — Picture I.F. Amplifier & Detecto
One 6AU6 — 1st Video Amplifier
One 6K6GT — 2nd Video Amplifier
One 6AL5 — D.C. Restorer
One 6AU6 — Limiter
Two 6BA6 — Sound Amplifier
One 6AL5 — Discriminator

- 6. I.F. FREQUENCY — AUDIO 21.6 — PICTURE 26.1

SIZE OF CHASSIS
19″x17″x3″

All of the above circuits are contained on one chassis, delivered completely wired, tested, tuned and tubed ready for installation.

AUDIO

Two Stages of Audio Amplification are used.

TUBES

One 6AT6—1st Audio Amplifier
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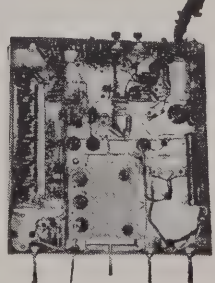

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Low voltage power supply is a well filtered supply using full wave rectification. Delivers 300V positive and 100V negative at 250 M.A. with good regulation at continuous duty.

High Voltage Supply is of the Fly-Back type delivering approximately 10K.V.

Power consumption approx. 300 watts. Both Supplies use the following tubes:
Two 5U4G — rectifiers as full wave rectification.
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SYNCHRONIZATION SEPARATOR

SYNCHRONIZATION AMPLIFIER SWEEP CIRCUITS

TUBE COMPLEMENT:
One 6J5 — Vertical Blocking Oscillator
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One 6K6GT — Vertical Output Amplifier
One 6BG6G — Horizontal Output Amplifier
One 5V4G — Damper
One 6SK7GT — 1st Sync Amplifier
One 6SH7 — Sync Separator
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One 10″ — Flat-faced Cathode Ray Tube

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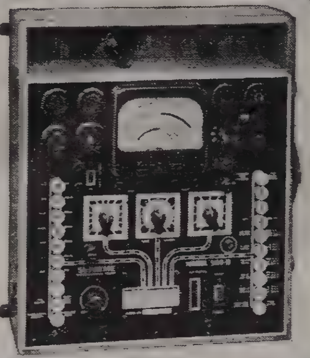
SUPREME MODEL 504B
TUBE AND SET TESTER



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One among the complete group of SUPREME radio testers is the Model 504B Tube and Set Tester.

- **METER—** large 4-inch square-face meter, 500 microampere.
- **SPEED—** push-button operated.
- **FLEXIBLE—** simple, yet Universal Floating Filaments feature insures against obsolesence.
- **SIMPLICITY—** roll chart carries full data for tube setting. No roaming test leads when using multi-meter—only push a button.

SPECIFICATIONS

DC VOLTS — 1000 Ohms per volt: 0-5-25-100-250-500-1000-2500.
AC VOLTS — 0-5-10-50-250-1000.
OUTPUT VOLTS. 0-5-10-50-250-1000.
OHMMETER. 0-200-2000-20,000 Ohms 0-2-20 Megohms

Condenser Check:
Electrolytics checked on English reading Scale at rated voltages of 25-50-100-200-250-300-450 volts.

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Check dry portable "A" and "B" batteries under load.

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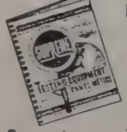

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the battery into the tester circuit is closed and the potentiometer is adjusted until the voltmeter reads 5.2 volts. The switch marked S_2 in Fig. 1 is closed. If the vibrator starts it is *good* and will likely give a great deal more service. However, if the vibrator fails to start at this point switch S_2 should be opened and the potentiometer adjusted until the voltage is close to 5.6 volts. Vibrators that start between 5.2 and 5.6 volts are *doubtful.* They may be expected to give trouble very soon. Vibrators that start only on voltages above 5.6 are *bad.*

If the vibrator successfully passes the starting test it should be tried for output voltage. The potentiometer is adjusted until the input voltage is anywhere between 6 and 6.5 volts. The voltmeter switch is then changed to the output position. If the voltage is normal and remains fairly constant the vibrator is *good.* But, if the vibrator produces a badly fluctuating voltage or a voltage below nine-tenths of the normal voltage it is definitely *bad.*

Making the Scale

Operating the vibrator tester and interpreting its indications may be simplified by calibrating the meter so that it reads like a tube tester. The regular card should be removed from the meter and a new one prepared. The new one may be made by drawing on thin white Bristol board with India ink or it may be made from white paper and pasted on the regular dial card. The new card may be laid off from the original, using it as a template or pattern. Two scales should be calibrated—input and output. The meter being a 0-1 milliammeter is marked from 0 to 1 by tenths. When used in series with the 10,000 ohm resistor for the input circuit it becomes a 0-10 voltmeter. Therefore, to calibrate the input scale, the portion from 0 to .52 is labeled *"GOOD,"* the portion between .52 and .56 is labeled *"?,"* and from .56 to full scale is marked *"BAD."*

To calibrate the output scale of the meter, the necessary data should be obtained before removing the original card from the meter. The potentiometer is adjusted until the input voltage on the vibrator is between 6 and 6.5 volts, the meter is switched to the output circuit to see if the rectified output is normal, smooth, and fairly steady. The readings *"GOOD"* and *"BAD"* may be established by testing known good and bad vibrators.

The meter when switched to the output circuit becomes a 0-500 voltmeter due to the 500,000 ohm series resistor. The average output of a good vibrator should be about 240 volts. This may vary considerably, however, due to the components used in making the tester. For instance, the vibrator transformer has a great deal to do with the secondary voltage.

The Circuit

The complete wiring diagram of

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the vibrator tester is given in Fig. 1.

The test voltage is supplied by a storage battery plus one cell of another battery. This gives about 8 volts across the potentiometer which makes it possible to adjust the input voltage on the vibrator to the desired points for making the tests. A push switch is used in the battery circuit so as to eliminate the possibility of unnecessary battery drain.

The meter with the two series resistors is essentially a two scale voltmeter, 0-10 and 0-500 volts. As you already know, any milliammeter becomes a voltmeter of a higher range when a series resistor multiplier is used.

The rectifier tube may be an 84, 6Z4, 6X5-G or 6X5-GT. The filament leads are run directly to the six volt battery. The filament must not be connected to the four cells like the potentiometer because the heater voltage of any of these tubes should never exceed 7.5 volts. The filament may be connected without regard to polarity.

The load resistor is a 5000 ohm, 50 watt unit. It should be mounted so it doesn't touch either the panel or the cabinet.

The 8 μfd. filter is an electrolytic condenser. The positive side of this condenser is connected to the cathode of the tube and the negative to the other side of the load resistor.

Wiring Hints

In building this tester there is no set rules of arrangement or wiring. It may be wired with heavy, flexible, insulated hook-up wire, however, all wiring in the primary circuit should be at least No. 14. The primary cable and common lead extending outside to connect vibrators not fitting the sockets should also be large wire. All joints should be soldered.

Construction Details

Because of the small space needed for the parts, the vibrator tester may be made into a small, neat unit. It may be built on a wooden, masonite, bakelite, or metal panel and mounted in either a wooden or metal cabinet. The author's tester is made on a 7½" x 10" panel and mounted in a carrying case style cabinet, the kind commonly used for tube testers.

All parts are mounted on the panel. The unit was completely wired before placing in the cabinet. The rectifier tube socket is mounted on the back of the panel near the top so that the tube hangs upside down in the cabinet.

The *"on-off"* push switch is at the upper left corner, just below the battery cable. The switch marked S_2 on the diagram is at the left of the meter. The input-output voltmeter switch, synchronous interrupter switch, and polarity reversing switch are at the right of the meter. The cables for connecting vibrators not fitting the two sockets come out just below the meter.

—30—

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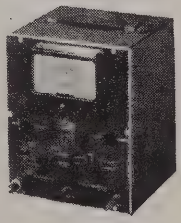

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Input resistance 11 megohms.
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A-C Electronic Voltmeter.
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Electronic ohmmeter:
6 ranges—0.1 ohm to 1000 megohms.

METER:
200 micro amperes, D.C. of rugged construction.
Accuracy—or 2% of full scale.

TUBES:
1—6SN7, 1—6H6, 1—6X5.

EQUIPMENT:
1—cable "D.C." shielded with connector and probe.
1—cable "A.C." ohms with plug and probe.
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"I have written to various advertisers hoping they would cooperate, but only one has replied, namely, *General Electric Co.*

"I appreciate that trading (due to shortage of dollars) between the two countries is limited but that will pass and the time will come when trade will flow once more, then the manufacturers who have been helpful to subscribers of RADIO NEWS will surely benefit.

"My interest in this subject is as a radio service engineer and I do appeal for technical details on American valves (tubes), electrolytic and paper condenser, also vibrators, all of which are seen in prewar and 'Lend-Lease' receivers over here but details of which are indeed difficult to obtain.

"Any help you can give will be appreciated.

"While writing I must congratulate you on the high standard you maintain in RADIO NEWS and say how helpful the articles on test equipment are. Please may we have more and more."

Robert Barlow
Devon, England

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* * *

MODEL NUMBERS—PLEASE

"AS I'VE been servicing radios since 1927, I feel that I have a right to voice an opinion—at last!

"There are many, many, radios on the market that do not bear a model number. Though I do not manufacture radios I can't see that it would incur any great additional expense or hardship if the model number were stamped legibly on each and every chassis.

"If those manufacturers who neglect this slight courtesy to those in the field who service their products, would themselves spend a month in the field, they would certainly find themselves doing a bit of cussing and might then understand the serviceman's point of view.

"A radio without a model number is worse than a tube without its proper designation.

"RADIO NEWS can do a lot in furthering the cause of the serviceman in this respect by requesting that the manufacturer be 'just a good sport'."

Felix F. Januss
Los Angeles, California

We highly agree with Mr. Januss. Let's hope that this letter will do some good.

* * *

CORRECTION PLEASE

"WITH reference to the article 'A Universal Voltmeter,' which appears in the June 1947 issue of RADIO NEWS, I believe that you should add a note of correction as indicated below.

"The meter described, if calibrated correctly on sinusoidal alternating voltage, will not indicate correctly on direct voltage (or on most other waveforms, for that matter). As an example, if calibrated on sinusoidal a.c., and if used to measure 115 volts d.c., the meter will indicate 128 volts instead of 115. The ratio is $2\sqrt{2}$ or 1/11.

"This is sufficiently important to be worth noting so that users of the meter will not be led astray."

J. N. Thurston
Massachusetts Institute of Technology
Cambridge, Massachusetts

Indeed it is! You are entirely correct in your reasoning. Our thanks to Reader Thurston for pointing out this omission in the text.

* * *

NO, NO, MR. POSTMAN

"ON PAGE 60 of the May, 1947 issue of your excellent magazine, the article 'Where Will You Find Them?' mentions the U. S. mailman as a source of forwarding addresses of former customers.

"All local mailmen have always told me that divulging a forwarding address would mean the loss of a mailman's job, and the same is what I have always been told at the post office. What gives?"

Jacob B. Marx
Cincinnati, Ohio

Far be it from us to fly into the face of post office regulations. If we were wrong on this lead—we are indeed sorry—and hope that none of our readers have impugned the integrity of the postal service by attempting to wring such information from his mailman.

—30—

Servicing Television Receivers

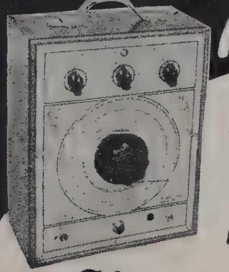
(Continued from page 43)

ment. Consequently television sets will be carefully interlocked to prevent out-of-cabinet operation. In some instances interlocks may also be applied to the capacitance in the deflection plate high voltage system, to short out the condenser when the chassis is removed from the cabinet.

Since these safety precautions are necessary to prevent the possibility of brute force shock and equipment damage, servicemen will have to learn how to check and service dead circuits or train themselves in high voltage safety precautions hitherto unnecessary with voltages seldom exceeding 300. The high voltage hazard will also accentuate the importance of insulation and the position of both components and wiring. Special attention will have to be given to the possibility of leakage and resultant damage to low voltage components.

The cathode-ray tube also introduces a new implosion hazard. Exhausted to high mu, the tube must be protected from rough handling, physical shock, or wide temperature changes in different parts of its glass envelope. Unlike standard radio tubes, the cathode-ray tube is a potential bomb and serious injury to the serviceman and the equipment may result from the careless dropping of tubes during servicing. It should always be removed and replaced with care. It should not be carelessly left on the floor or bench where it may be broken accidentally.

Recognizing the viewing tube implosion hazard, set manufacturers will provide a safety glass shield for the tube face. The purpose of this shield is to prevent personal injury which may result from tube implosion, and to prevent accidental contacts by children, vacuum cleaner handles, and other home hazards. It should never be removed unless absolutely necessary and under no circumstances should a television receiver be returned to the owner without it. The implosion hazard increases with



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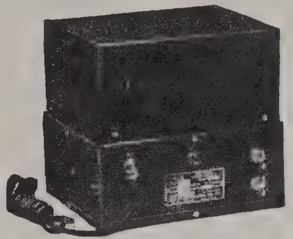

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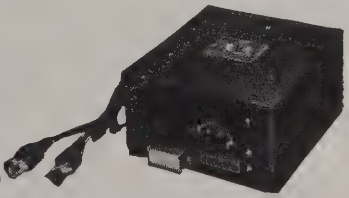

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an increase in the size of tube screens. Tubes with larger than five inch faces may implode with terrific force which will demolish both cabinet and the set itself. Obviously anyone in the immediate vicinity is liable to permanent personal injury.

Viewing tubes also present a problem of electrical adjustments unlike those previously experienced in standard broadcast sets. In general all adjustments of the video components are critical. For example, electromagnetic type tubes require ion-trap coils to prevent ion spot and the resultant burning of the tube screen. If the coil is not properly adjusted ion spot trouble may be eliminated but quality of the electron beam may become impaired and result in a poor image. Iontrap adjustment requires the checking of the raster pattern by applying approximately 300 volts to the neck of the cathode-ray tube. The applied voltage must be in proper position with respect to the internal pole pieces and the neck of the tube.

Projection type sets will be equipped with optical systems that will require a basic understanding of optics by the serviceman. While systems similar to those used in cameras and motion picture projectors may be used, a fundamental knowledge of the new Schmidt lens system will also be useful. In view of the high cost of grinding lenses to optical quality, plastic lenses, inexpensively molded may come into general use. Electrostatic attraction of dust in the projection lens system may result in a regular maintenance job. If plastic lenses become standard the serviceman will have to become adept at removing, cleaning, polishing, and replacing relatively soft materials without damage.

Television service will require an expanded knowledge of power supplies for the high voltage, low current demand of the cathode-ray tube deflection system and the relatively high current, low voltage demand for other receiving tube plates and heaters. High voltage supply may appear in several forms including: 1. r.f. high voltage, rectified; 2. flyback supply from scanning coil; 3. standard type, built-up from 60 cycle supply.

Each of these high voltage supplies has advantages and disadvantages which will affect the serviceman's problem. The r.f. high voltage rectified type provides the poorest regulation while there is the greatest hazard in the type built-up from 60 cycle supply.

Power supply for the other receiving tubes will be enlarged to supply plate and heater needs for complements ranging from sixteen to thirty tubes or about four to six times the current demand for the average AM broadcast receiver. Transformers, chokes, resistors, and wiring will require higher current ratings for satisfactory operation without excessive heating. Where multiple power supplies are used for individual circuit components the serviceman's trouble-

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shooting time will be appreciably increased.

The initiation of the average serviceman to television servicing may come through the installation of the set and its antenna. It is in this activity he may make or break his opportunities in the television field. Television sets, unlike standard broadcast receivers, cannot be sold on a take-home, plug-in basis. Because of this, department stores and many other retail outlets will hire servicemen or train their own personnel to specialize in television set installation. How well or how poorly the serviceman does the antenna job will determine the public's attitude toward his ability to perform professional service.

Without a good antenna, properly installed, good television reception cannot be expected. In this way a new market for labor and material is being created for alert servicemen. In instances of apartment house installations as many as four antennas and carefully installed transmission lines may be required. This may create a new need for public relations for radio servicemen . . . to provide the good-will and permission of apartment owners and their superintendents for antenna installation. Outside antennas must also comply with the Underwriters' Laboratories requirements, and in many instances with local ordinances, building codes, and other regulations. —30—

Reflective Optical System

(*Continued from page* 56)

Solution of all the above problems culminated in the final development of a *projection* kinescope—the type 5TP4—having all the desired visual and electronic characteristics for large-screen image projection. The tube is normally operated with a potential of 27,000 volts, providing great brilliance on a high-contrast white-light fluorescent screen. About five times as much light is projected onto the large, final viewing screen as could be delivered from tube to screen by a conventional F:2 motion-picture projector lens *without* loss of final-image quality.

Background

The *RCA* reflective optical system for television projection is a development evolved from the reflection principles of optical apparatus devised by Kellner and by Schmidt.

Forty years ago, an American lens designer, Kellner, patented a reflective optical system for light transmission by searchlight or by the headlights of an automobile. Twenty-five years later or fifteen years ago, a German optician, Schmidt, invented a camera with a reflective optical system which provided a large aperture ratio and a wide field of view, and was widely used in astronomy.

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the two men had worked independently in their own specialized fields of endeavor and to accomplish entirely different objectives, *yet they both developed essentially the same type of reflective optical system.*

Since his equipment was used extensively, Schmidt is generally given full credit for developing the reflective optical system as an aid to photographic work in astronomy. However, Kellner's conception of the system considerably predates that of Schmidt.

The successful development of large screen projection for television is the result of a group effort by many members of the *RCA* technical staff, but a large share of the credit for results obtained is due Dr. D. W. Epstein, in charge of the Optics and Cathode Ray Tube Section at the *RCA Laboratories.*

While it is too early to state the probable image sizes that will be definitely preferred by the public, there will be produced at least several receiver models equipped with observation screens of a size measuring 18x24 inches, 24 x 32 inches, 30 x 40 inches, or larger—for rooms accommodating large audiences, hotel lobbies, small auditoriums, and the like. The reflective optical system can be used for almost any size of large-screen projection in any type of receiver having sufficient interior cabinet space for mounting the optical elements.

Using essentially the same basic system of projection, large-screen theater-television equipment (Fig. 3) has been designed and used successfully. The optical part of the system includes an extremely brilliant picture tube operating at a potential of 70,000 volts, a 30-inch reflecting mirror, a 22½ inch glass lens to correct for spherical aberration, and a projection screen measuring 15x20 feet. The system embodies the same principles as the basic reflective optical system previously described.

Into the Future

Future use of projection television, in new models of *RCA* home receivers, and equipment for large-screen theater projction, will make use of this same, basic system of optical reflection (Fig. 5) with any necessary mechanical modifications and, when developed, any possible improvements in the brightness and efficiency of the system.

Considerable research is now being conducted in the realm of synthetic luminescent materials, to discover a phosphor compound which can be used with much higher operating voltages to produce even brighter television images. This includes improvements in the technique of coating phosphor layers with a thin, metallic film to increase the brightness and contrast of a picture tube.

Other improvements in the projection-type kinescopes will permit, eventually, much higher accelerating voltages and greater beam intensity.

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the reflective optical system itself no extensive changes are anticipated in the future. However, general research in the field of optics will continue in an effort to provide optical systems of much greater efficiency.

Essentially the same basic method of optical projection will some day be used for chromatic television, both in home receivers and large-screen theater equipment. In each case, three complete and independent optical systems would be necessary—with countless other modifications. However none of this equipment will be completely developed for a great many years.

Because projection television now provides an unprecedented opportunity for reaching a greater number of listener-viewers *per television receiver,* there is likely to be extensive interest aroused in large-screen television, on the part of advertisers and merchandisers, and by individuals never before interested in the video art.

At such times when lavish musicals, plays, or other high-cost stage productions are televised, a much keener appreciation of the broadcasters' efforts will be possible through large-screen reproduction.

Entertainment and merchandising are but two aspects of television, however, with hundreds of new uses yet to be explored or investigated.

In time, television will be unsurpassed as an important *visual* means of education, enlightenment, observation, exploration, training, and information—a source of culture, truth, and knowledge.

A completely new philosophy of education, *visual* education, can be extended to many schools and countless classrooms, to homes of invalids, and farms in rural districts. The study of trades and crafts and specialized professions will take on new meaning under guidance of skilled artisans, acknowledged experts, and master craftsmen.

In other fields: Wherever vision is needed, television can supply the sight!

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As its many potentialities develop, television will become more than an art, more than an industry. It will be a powerful source of knowledge, thought, and opinion, assuming a dominant role in human affairs. Television will become a great and vital influence in shaping the World of Tomorrow!

—30—

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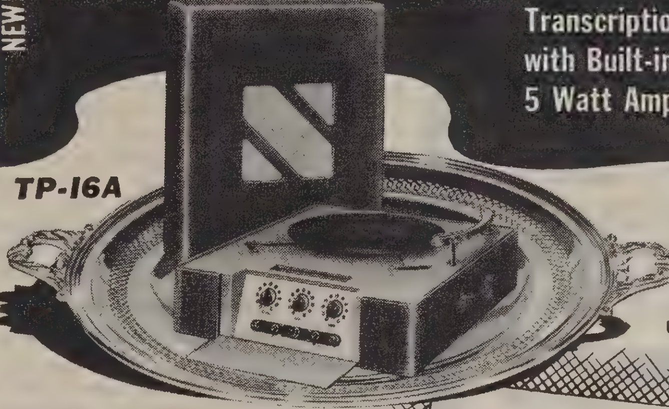

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Television Installation

(*Continued from page* 46)

jam the receiver too close to a wall or other back surface.

Make certain that all tubes are firmly in sockets, and that all grid leads to tops of tubes and all chassis plugs are in place. Often these are jarred loose during shipment. Now, with no lead-in or antenna connected, turn on the receiver. Switch to the channel of a television station that's known to be on the air. Then adjust receiver controls to obtain some sort of picture image, even if it's very weak. (Weak signals are apparent by their lack of brightness *plus* a "snowy" or "spattered" effect over the entire received picture. At this stage of the installation, such picture weakness is usually normal.)

If signals *cannot* be received and the set is known to be functioning properly, a makeshift antenna may be necessary to check operation of the set. Cut two pieces of any kind of wire, each about 3 feet in length and as straight as possible. Connect a wire to each of the two input terminals of the receiver, to simulate the appearance of a dipole. Some sort of signal should be received, and set controls are adjusted to obtain the best picture possible.

The received sight and sound must be synchronized! *If they are not,* the receiver is definitely out of alignment and therefore would be operating improperly.

All adjustment of the receiver controls should be according to the manu-

---

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The Continental Network operating from its home station, WASH, in the nation's capital, is now serving nineteen stations in a six-state area. Utilizing both 8 kc. land lines and aerial pick-ups, this network provides three top Washington features, the Army Air Forces Band, the U.S. Army Band, and nightclub singer Dona Mason, to FM listeners in many Eastern cities.

Land lines are used to connect station WASH with station WFIL-FM in Philadelphia and W2XMN and W2XEA, Major Edwin H. Armstrong's experimental station at Alpine, New Jersey. From Alpine the programs are picked up by either land lines or by air and distributed to outlets throughout the coastal area.

The accompanying map shows the nineteen station net. Land line hook-ups are indicated by dotted lines while aerial pick-ups are shown by solid lines.

At present the network is operating on a non-commercial basis with special emphasis being placed on selling the advantages of frequency modulation broadcast services. Hook-up costs, even when telephone lines are used, are shared by anyone joining the network. Although the home station is now operating with 650 watts of effective radiated power, it is expected that WASH will operate on 15,000 watts in the near future, at which time it may be possible to eliminate some of the telephone wire hook-ups.

As the first broadcasting relay in the history of FM combining radio and telephone circuits, WASH is not resting on its laurels. New and improved methods of transmission and expanded coverage are currently being sought with the hope that soon a nationwide FM hook-up may be in operation.

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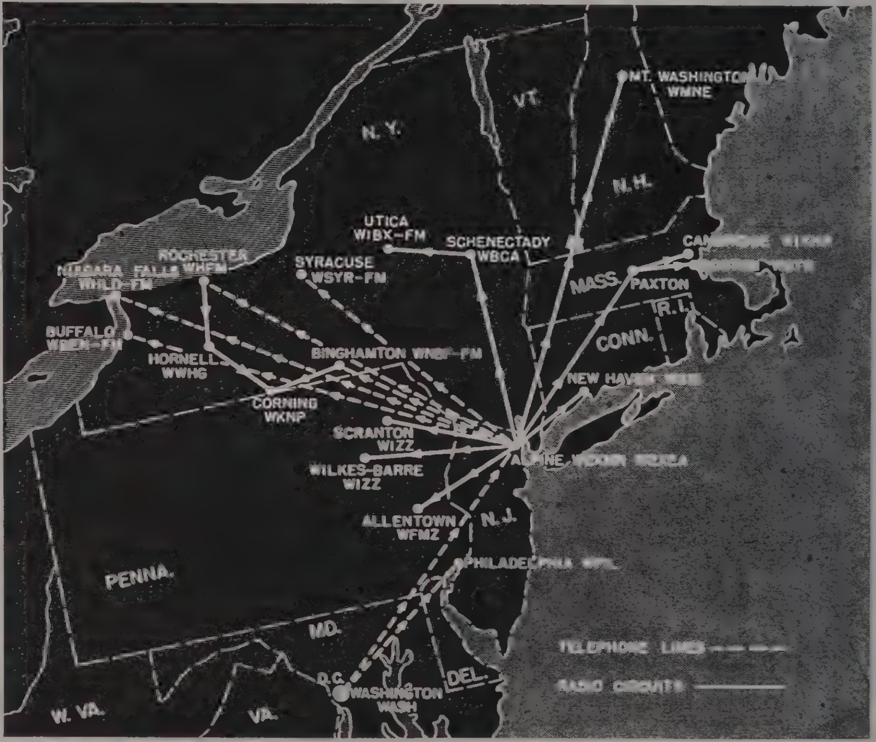

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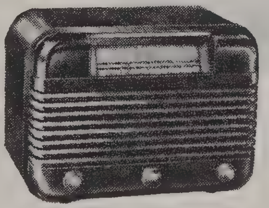

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- Built in Regaloop

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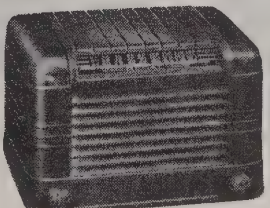

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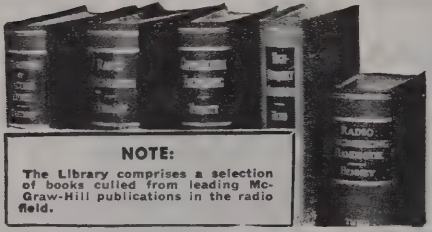

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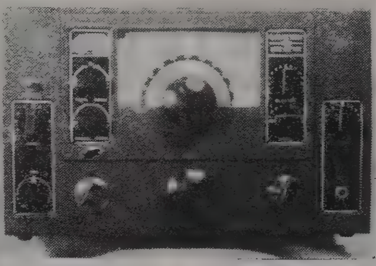

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facturer's instructions for operation of the particular set.

After tests prove the receiver is functioning properly, remove the makeshift antenna. Leave the set turned on, and switched to the same television channel, while preparing the lead-in and matching section.

The Lead-in

A two-wire lead-in is used between the dipole and the receiver, specially constructed and tuned to deliver maximum signals to the input of the receiver. The two principal types of lead-in are "twin-lead ribbon," and coaxial cable. "Twin-lead ribbon" is often referred to as a *balanced* lead-in. Coaxial cable is known as an *unbalanced* lead-in, because one wire (represented by the *shield* of the cable) is grounded.

"Twin-lead ribbon" (Fig. 3) is the most popular type. It's used in the majority of television installations in suburban and residential districts, and for all other locations where noise interference isn't too great.

Use of coaxial cable is restricted to certain locations which are extremely noisy. Further data on the several types (Fig. 4) will be given in a subsequent article.

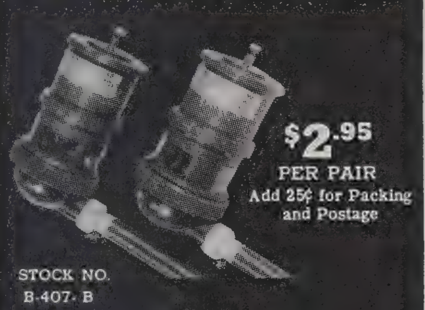
Of present concern is the new and popular "twin-lead ribbon," a flexible twin-conductor that actually looks like a narrow, thick ribbon. The two wires are spaced, encased, and thus insulated by a weather-proof plastic known as *polyethylene.* It dries quickly, and stays clean. It's commercially available in several width sizes, determined by the natural *impedance* of the "ribbon." Most useful size for television is the *Federal* type K-1046, which is about ½-inch wide and has a 300-ohm *impedance.* You'll need plenty of this lead-in for all types of television installation work. "Twin-lead ribbon" is also available in much narrower widths; one size with 150-ohm *impedance*, one size with 75-ohm *impedance.*

The impedance of the lead-in is important. Every type of lead-in has an impedance, rated by the manufacturer. Every dipole has an impedance at its center point where the lead-in is connected; this is *about* 75 ohms for a simple dipole. The input to the television receiver *also* has an impedance rating, around 300 ohms, but in rare cases it may be 75 ohms.

To receive maximum signals from any television station, the impedance of the receiver and the impedance of the lead-in must be matched or equal, and the impedance of the lead-in and the impedance of the dipole must also be matched or equal.

The input impedance of most television receivers is specified: *300 ohms.* This means that a lead-in *rated at 300 ohms* must be connected to the input terminals of the set. And 300-ohm "twin-lead ribbon" is used.

The center impedance of the dipole, however, is 75 ohms (approximately) and this does *not* match the 300-ohm



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impedance of the lead-in. To connect such a mismatch results in loss of signal power *and is undesirable in a good television installation.* For this reason, a matching section should be used, between the dipole and the top end of the lead-in, to compensate for the mismatch.

A matching section is constructed from a piece of 150-ohm "twin-lead ribbon," and connected as shown in Fig. 5. The length *L* of the matching section is determined from Table 1, according to the customer's preferred channels for reception. The length *L* is not too critical. Simple connection of matching section to dipole is shown in Fig. 6.

To construct a matching section connecting a 300-ohm lead-in to a 75-ohm dipole, you must first know the Primary and Secondary Channels preferred by customer. Then refer to Table 1, and determine length *L* for each of the two channels. Take the *average value* of these two lengths, and the result will be the best length *L* (in inches) for the 150-ohm "twin-lead ribbon" matching section.

For an installation designed to cover *all* channels, use a length of 37 inches (mean value for all channels) for the matching section.

If the antenna impedance is 300 ohms (in the case of a *folded* dipole, to be discussed later) a matching section will *not* be necessary. If the antenna impedance is 75 ohms (approximately) and the input terminals of the receiver are marked 75 ohms, the lead-in should consist of a sufficiently long amount of narrow-width 75-ohm "twin-lead ribbon." Here again, since all impedances are matched or equal, a matching section will *not* be necessary.

In the overwhelming majority of installations, however, the input impedance of the receiver will be indicated or rated as 300 ohms. For all such cases a 300-ohm "twin-lead ribbon" is used.

From your earlier survey of the customer's house or building, you have estimated the approximate length of the entire lead-in. Add about 20 percent slack to allow for error and to permit later "probing" operations on the roof. Then cut the required length of "twin-lead ribbon" for the lead-in.

If a matching section is required, construct it according to Table 1 and connect this short length of 150-ohm "ribbon" to one end of the lead-in.

Assemble the commercial dipole, according to the manufacturer's instructions for the particular type. Next connect the free end of the matching section to the two metal rods of the assembled dipole (Fig. 6). The distance between rod contacts is not too critical at this time as it will be adjusted later during actual tuning procedure.

The complete antenna, with lead-in and matching section attached, is taken to the roof (Fig. 7).

The lead-in should now be run *loosely* from the roof to the receiver,

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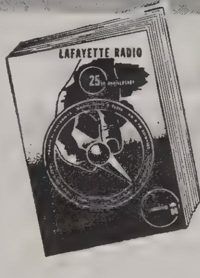

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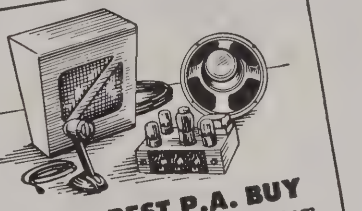

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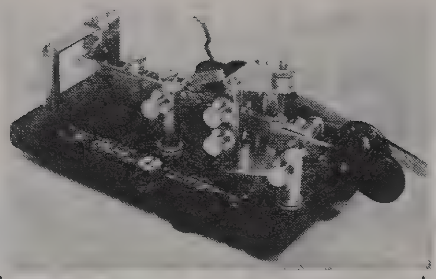

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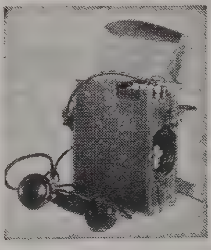

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following the most likely route of final installation. This route must be convenient and generally remote from pipes and large metal objects, neon signs, electric switches, motors, and generators. The lead-in may be as long as necessary to avoid these interference pitfalls. Leave considerable slack in lead-in.

Don't install the lead-in permanently at this time. With lead-in connected to both receiver and dipole, recheck operation of the television receiver. Adjust controls for a bright, clear picture on either of the preferred channels.

The *Basic Procedure* next calls for simultaneous work by a technician on the roof with the unmounted dipole and by a technical observer at the receiver. Some means of communication between the two men is necessary. For this purpose use any available two-wire, battery operated telephone system. (Figs. 1 and 2.) Earphone-and-speaker set on roof and similar set at receiver are connected by two wires. Wires can be of any kind or type, but they must be covered to prevent short-circuiting. Allow plenty of slack to permit free movement of the technician over most of roof.

The Dipole

The most widely used antenna for television reception is the single dipole. It consists of two metal rods placed end-to-end and held in a horizontal position by wooden supports (Figs. 6 and 7). The entire assembly is mounted upright on a wooden pole. The two metal rods are indentical.

The *length* of each metal rod is a factor in tuning the entire dipole. By choosing the proper length, at the time of installation, the dipole can be broadly tuned to a preferred channel or group of channels.

The information contained in Table 2 is all you need to determine the best length for each dipole rod to receive *certain* stations operating in your area. Use Table 2 in this way: If only one television station operates in your area, determine the channel number and refer to the second column for the best length (for each metal rod) to receive that channel. If two stations operate in your area, determine their channel numbers and refer to the second column for the best rod length for each channel. Then take the *average* of the two figures to determine the best rod length to receive *both* stations.

If there are three stations operating and reception of all three is possible, obtain the best rod length for each channel from Table 2. Then take the *average* to determine the best rod length to receive all three stations.

For reception of four, five, or all six channels *by a single dipole,* use a (mean average) rod length of about 41 inches.

Reception from any television station is greatest when the dipole is facing *broadside* to the station's transmitter. Thus, multiple-station

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use of a dipole will require some compromise in position or orientation. However, signals can be received *from either side* of a single dipole.

By adding a directional element, either a *director* or a *reflector*, use of the dipole for multiple-station reception is limited, since the antenna is highly directional. But such arrangements have other advantages, which will be discussed in subsequent articles.

Most important steps in the *Basic Procedure of Installation* are the location, orientation, and tuning of the single dipole antenna.

Details of the procedure are considerably influenced, however, by the size and structure of the customer's house or building *and by its geographical and geophysical location*. As an example, antenna installations in city localities often require more complicated work than installation in suburban districts. For this reason, the remaining portions of the *Basic Procedure* are purposely general, covering all types of installations.

Specific details covering each of the main *types* of installations, *suburban dwellings, city dwellings, apartment houses, and large buildings*, will be treated independently in subsequent articles.

Final Work

The best site for locating the antenna is determined accurately by a trial-and-error method, known as "probing."

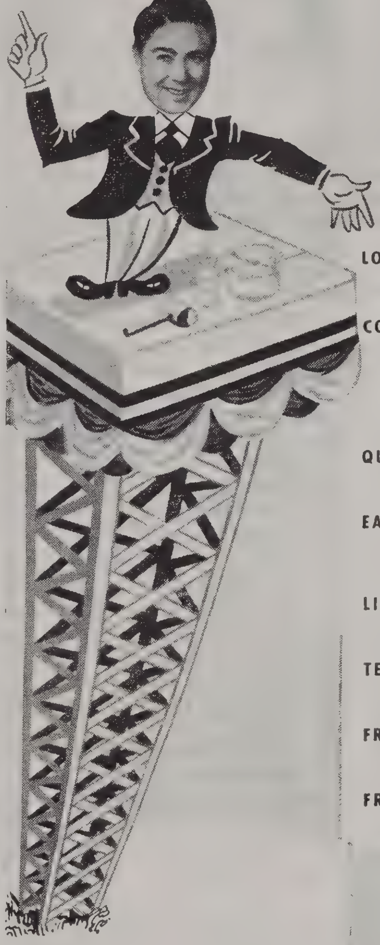
The assembled dipole, connected to the receiver by a long, loose lead-in, is held upright by technician on the roof (Fig. 1). A second man is stationed at the television set, and observes the received pictures (Fig. 2). The two men communicate by means of the portable telephone sets.

As the antenna is moved through various positions on the roof, the desirability of each site is judged *at the receiver*—in terms of relative signal strength and picture quality—for both the Primary Channel and the Secondary Channel.

When all likely or accessible areas of the roof have been "probed," the most promising locations are *re*tested, on *both* preferred channels, until the best, single location for the antenna is found. The site is then marked and the roof technician installs a heavy metal mounting bracket, designed to hold the upright mounting pole. The antenna is then mounted in a semi-fixed position for orientation.

With the receiver switched to the Primary Channel, the technician on the roof rotates the antenna assembly *in the mounting bracket* while the man at the set observes strength and quality of pictures for various bearings of the antenna.

The best signal is received when the dipole is broadside to the distant transmitter of the television station. On foggy or overcast days, *or* when the station is just beyond the horizon *or* when human visibility is otherwise



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limited or obscured, the direction of a station can be verified by using a small compass.

Antenna position for best signals from *Primary Channel* station should now be noted by man on roof. Then, the entire orientation procedure is repeated for the *Secondary Channel,* to find the best position of the antenna for *that* station.

To find a good, *average position* of the antenna, permitting very good reception on the *Primary Channel* and fairly good reception on the *Secondary Channel,* switch back and forth between the two preferred channels as the antenna position is varied.

When a strong television station is located in the immediate vicinity, it is sometimes advisable to turn the dipole slightly, favoring a weaker station. In general, whenever a single dipole is used for multiple-station reception, usually some compromise of bearing position is necessary.

After orientation, final tuning of the antenna is accomplished by adjusting the space-separation of the two metal rods of the dipole, while the man at the receiver observes comparative signal strengths. All other tunable factors of commercial antennas are adjusted in the same manner.

When the dipole is located and properly tuned, the position of the antenna is permanently secured at the metal mounting bracket. The weight of the antenna should be sustained by the bracket alone, but guy wires may be used when necessary in the interest of safety.

The "twin-lead ribbon" lead-in is installed permanently. Wherever possible, polystyrene stand-off insulators should be used (Fig. 3) to assure good space separation from surfaces likely to become wet during bad weather.

Small wooden blocks can be used to mount the "ribbon" lead-in but this is not particularly recommended. The "ribbon" can be secured directly to roof or wooden surfaces with fibrehead nails but this procedure gives the least desirable results.

Start this work on the roof at the antenna, and proceed downward, avoiding pipes and large metal objects en route. During installation, the man at the receiver watches picture signals to detect indications of unsatisfactory lead-in positions, such as slight interference from neon signs, motors, etc. Route of the lead-in must be altered, if necessary, to eliminate or minimize such interference or other extraneous effects.

After the work has been completed, remove all slack from lead-in *at the receiver.* Then reconnect "ribbon" lead-in permanently to input terminals of the set. Install lightning arrestors, and finish all construction work.

The completed television installation should reflect good workmanship as well as technical skill and ability.

These are the *general* aspects of the *Basic Procedure of Installation.*

(*To be continued*)

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(*Continued from page* 65)

shield dividing the unit in the center. This very nicely isolates the tuning components so that any heat given off by the tubes cannot cause drift.

The tube used as an electron-coupled oscillator should have good screening for the sake of stability. The new type 6BA6 miniature meets this requirement and, in addition, it is small enough so that it can be mounted directly on the shield. Thus, while the terminals of the socket are in the left compartment, actually the bulb or heat radiating section is in the other compartment.

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As indicated in the schematic the plate circuit is untuned, and consists of a 2.5 millihenry choke. This method is very satisfactory and eliminates the need for a tuned circuit. The isolation or buffer stage consists of a type 6AQ5 miniature beam power tube.

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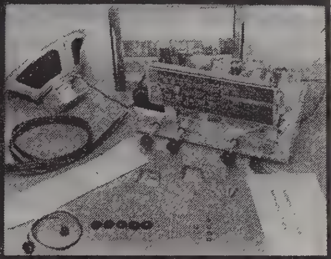

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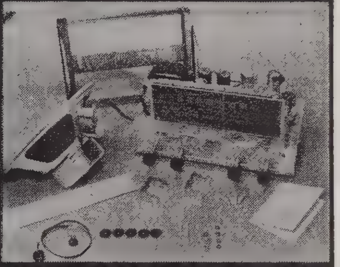

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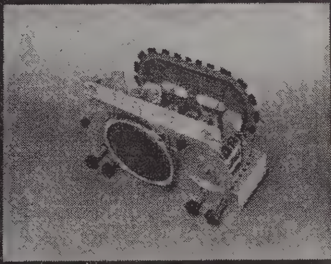

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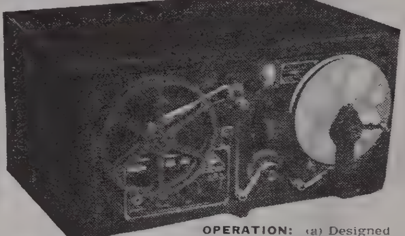

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(b) Can be used as a separate tape puller and take-up unit for use in conjunction with certain types of recorders which do not perform these functions.

(c) Can be used in conjunction with a transmitter and/or Code Recorder BC-1016 to send or relay messages at high speeds (etc.).

OUTPUT: Audio signal of 800 cycles. Three output impedances of either 4, 8 or 15 ohms for coil load matching.

COMPONENTS: 110 volt Variable Speed Drive Motor—Take-up reel—Practice reel of inked tape—Technical manual—Photo Electric system—25 Watt Amplifier and oscillator circuits **Complete with the following tubes:** 2—6N7's; 2—6SJ7's; 2—6L6's; 1—5U3G; 1—923.

Complete ready to use in steel cabinet 11" high x 24" wide x 18½" deep, wt. 63 lbs. Designed to fit any standard 19" relay rack. Height is 8¾" and weight 40 lbs. when cabinet is removed for rack mounting. Fully equipped and assembled. Just connect to your headphone, etc., and plug into your 110 volt 60 cycle power line.

Surplus—New—Guaranteed

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A TRANSMITTING & RECEIVING SET

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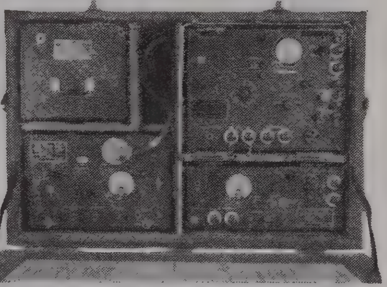

SIGNAL CORPS S. C. R.—178

2400 to 3700 K.C. Master Oscillator Tuning C.W.-Voice-Tone; 5 Watts, 25 mils. on C.W. Takes in some police, marine, aircraft and amateur bands. Consists of 4 SEPARATE COMPONENTS: Transmitter, Receiver, Modulator and Battery Box. Receiver operates separately on standard radio A, B and C batteries. Transmitter operates from any external source of 8 volts at 3.25 amp. and 500 volt at 100 M.A. Set uses the following tubes: 1—#10; 1—#865; 2—#34; 4—#30.

To be put COMPLETELY into operation you require only the following: Batteries, tubes, headphone, mike, key, antennae, and power source for transmitter.

In this set are 3 meters: 0-1 Amperes R.F.; 0-200 Milliamperes D.C. and a dual range 0-3.5 and 0-140 D.C. Voltmeter; THE COMPLETE SET CAN BE PURCHASED FOR ONLY THE PRICES AT WHICH WE NORMALLY SELL ONLY THESE THREE METERS $8.95, F.O.B., N.Y. This set is worth many times this special price as it can be readily modified or used for the valuable parts it contains.

Condition: Guaranteed New—Never used, not rejects—in perfect operating condition. Made by Allen B. DuMont Laboratories, Inc. Shipping wt. 80 lbs. Dimensions: 25½"x17½"x10½".

What's the hitch? There is none! We SPECIALIZE IN ALL TYPES OF METERS but do carry various components such as this from time to time. We have only 390 of these units left in stock and we won't have them long at this amazingly low price so get your order in while the getting is good.

BC-1072-A RADAR TRANSMITTER

150 to 210 Megacycles; Operates off 115 volt, 60 cycle power line. This unit can be adapted to a 2 meter band transmitter but its chief value is for the parts it contains.

BLOWER. 115 volt 60 cycle 28 watts .38 1525 R.P.M. A.G. Redmond.

VARIAC. Gen. Radio type 200 B 115 volt input. 135 volt 1.5 amps. Max. output.

TUBES. 2—5U4G's; 1—807; 1—2x2; 1—6SN7; 1—6J5; 1—9002; 2—9006; 2—826.

METER. Simpson. 3½", round, 0-5 Kilovolt and 0-10 M.A., D.C

TRANSFORMERS. 1—with primary variable from 0-135 volt, secondary from 0-3500 volt; 1—with primary 117 volt secondary 6.3 V at 1.2 Amp. 275 volt center tap to each side, 5.0 volt at 3 Amp.; 1—with 117 volt primary, secondary 4 volt at 16 amp. and 2.5 volt at 1.75 amp.

Consists also of many other parts, relays, transformers, circuit breakers, interlocks, resistors, chokes, too numerous to itemize.

Complete in metal cabinet 18"x20"x17½"; net wt. 150 lbs.

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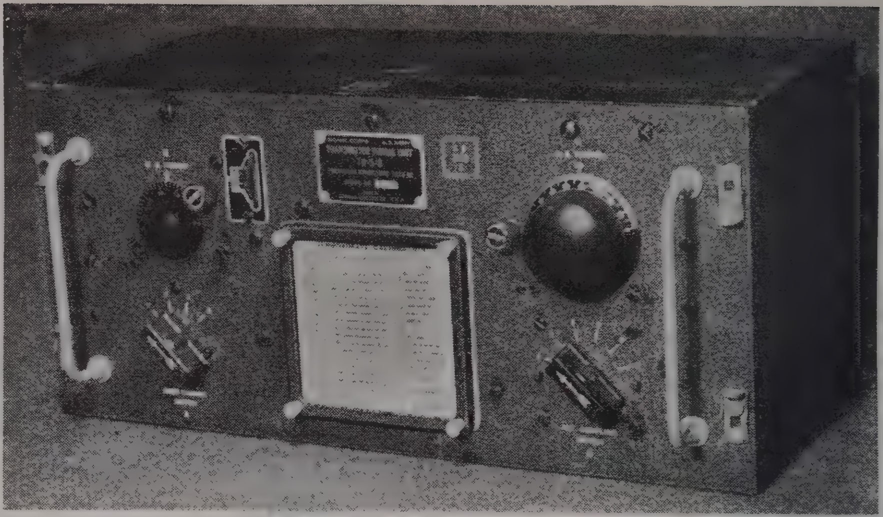


Panel view of the original tuning unit, TU-5-B, as it is obtained from war surplus.

its dissipation does not become excessive when the e.c.o. is turned off.

The 6BA6 plate and screen potentials as well as the 6AQ5 screen are held to close limits by the VR150 regulator tube. The 6AQ5 plate is supplied direct from the filter output, ahead of the regulator. With the e.c.o. turned on and oscillating, resistor R_4 should be adjusted so that the current flowing through the VR150 is approximately 17 milliamperes. This setting is most conveniently made by temporarily connecting a milliammeter in series with the VR tube's cathode.

The power supply, together with the 6AQ5 tube, is mounted on an aluminum shelf which is mounted in the original unit by means of four small angle brackets. The calibration chart, originally mounted in the center of the front panel, is relocated near the right end of the panel. This is done to cover up several holes that are exposed in the panel by the removal of a variable condenser. Incidentally, this chart is ideal for the v.f.o. calibration chart.

Removing the neutralizing condenser from the center of the panel also left a small slot in panel. This slot was enlarged so that a pilot light bracket could be mounted. Other small screw holes in the panel were filled up with black-head bolts which were left over from parts removed from the original unit. An "on-off" power switch may be added but it has proved more practical to have the v.f.o. power supply and heaters come on when the station's receiver is turned on. Very little additional power is consumed and it insures stable operation at all times. A toggle switch connected in parallel with the rear keying terminals of the e.c.o. affords a convenient means of making the e.c.o. operable without throwing the station's transmitter on the air. In this way the v.f.o. may be set to the desired frequency prior to going on the air.

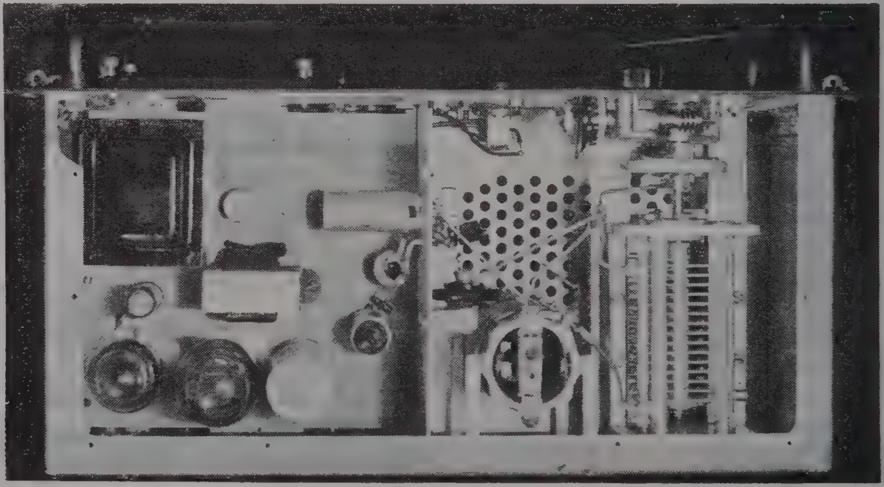
The e.c.o. follows a bug beautifully with no noticeable chirp. If a chirp develops it may be necessary to decrease the value of C_5 screen bypass. However, the .01 μfd. should be correct.

Placing four *Lord* shock mounts on the bottom of cabinet completes the job.

The builder will find this unit compares very favorably with commercial v.f.o.'s now on the market.

—30—

Under chassis view shows location of component parts in the completed v.f.o.



New Radio Outlet

(*Continued from page* 47)

it pays off—didn't they sell 2000 Eddie Howard records in one weekend when he was making a personal appearance in Peoria?

The story told in the window is a continued one, for when the customer steps into the store the floor displays take over the job of selling. A long record rack, capable of housing 175 albums, extends along one side of the store. Special sections of this display are given over to classical and to juvenile albums. Single records are also allocated space on this display with over 2000 titles on hand to tempt the prospective customer.

Table model combinations and radios are grouped together in a special display fixture near the record department. Adequate provision has been made for connecting each and every receiver so that it can be demonstrated on the spot without the necessity for carrying the merchandise to an outlet. By having merchandise of similar type grouped together step-up selling becomes relatively easier and increased profits will result.

Consoles are displayed on a four-inch high platform at the rear of the store. This arrangement permits customers to view the merchandise in a favorable setting without being disturbed by heavy store traffic. Each week one console is featured in a special setting which simulates a "home" atmosphere by the use of lamps, pictures and end tables.

Hiding all this "light" under a bushel is not in keeping with the policy of the store—so they tell their public about the merchandise in display ads which tie-in with their window displays; tiny two-inch ads which appear daily and keep the company's name and products before the public; monthly direct mail campaigns which consist of folders, circulars, and booklets furnished by manufacturers; monthly lists of new records; a 25-minute program, "Platter Parade" which is aired each Saturday evening and features the newest discs handled by the store; and personal solicitation by trained personnel.

In addition to these market-wise techniques the store dares to be different by staying open evenings until 9 p.m. Believing that many radios and appliances are purchased as a result of husband-wife shopping, the store makes it easy for the family to select new merchandise for the home. The large proportion of the store's business which is done in the evening seems to justify the owner's stand on this point.

Thus, in various ways, *Smith & Applegate* have made a success of their business because they have anticipated their customers' needs and have dared to "be different."

—30—

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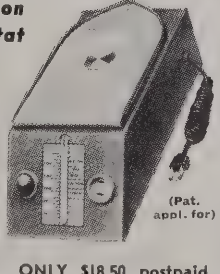

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UNGAR *Points*
THE WAY TO BETTER SOLDERING

A LITTLE IRON THAT WILL
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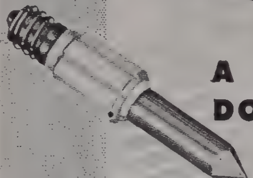
No. 536 Pyramid Tip, made from Tellurium

No. 537 Pencil Tip, made from Elkaloy A, Tip 1/8" dia.

Built for speedy accurate soldering, this powerful little pencil iron will perform rugged heavy duty jobs as well as those requiring intricate exactness.

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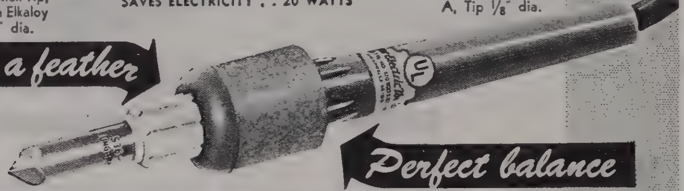
LIGHTWEIGHT . . . . 3.6 OUNCES
HANDY SIZE . . . . . . 7 INCHES
SAVES ELECTRICITY . . 20 WATTS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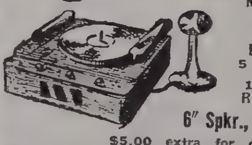
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5 Minutes' Recording on a 10" Record
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Ready to operate with
6" Spkr., Crystal Mike $49.50
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1. Ideal for music lessons, parties, your child's cute sayings, etc.
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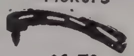
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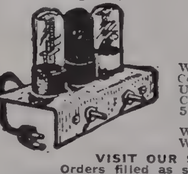
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Wired Vol. & Tone Control............$2.95
Uses 12SQ7, 50L6, 35Z5. Complete with 3 tubes and 5-inch speaker in kit form. $7.50
Will drive a 6"-8" Spk. Wired and tested....$8.00

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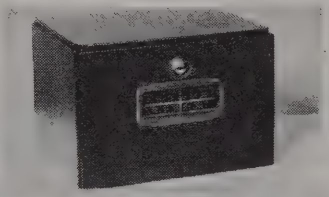
NEW F. M. TUNER!



Here is what you have been waiting for to attach to your present amplifier or radio to give you staticless, quiet radio reception characterized by the Frequency Modulation method of transmission.

The new 11 tube COLLINS FM tuner is supplied as a chassis unit, with rack panel or in attractively styled cabinets (illustrated) presented in a variety of leatherette finishes. Its utility is therefore three-fold in being readily adaptable to any existing set-up: console mounting, recording studios and broadcast stations or in the living room of your home, blended perfectly with the surroundings.

Not a competitive tuner but the best.

See your local jobber and if he cannot supply you write us direct.

COLLINS AUDIO PRODUCTS CO., INC.
126 PARK ST. WESTFIELD, N. J.

Television Counters

(*Continued from page 53*)

ing only when the trigger tube fires. When the first section is conducting the plate current flows and discharges condenser C_2 so that it is ready for the next step count. Output is taken off of the second section plate in the form of a long duration negative pulse.

Blocking Oscillator Counter

Another type of counter used in the sync generator is the blocking oscillator type shown in Fig. 6A. The blocking oscillator is an arrangement of charging diodes and condensers. The step charge condenser is in the grid circuit of the blocking tube. The blocking tube itself does not produce continuous oscillations but only produces bursts of oscillation when the charge on the condenser is sufficient to drive the tube into conduction. The blocking tube is normally biased beyond cut-off by the positive voltage applied to the cathode. The voltage on the grid condenser builds up in steps and finally reaches a value which is sufficient to drive the blocking tube into conduction. Instantaneously, a sharp burst of plate current is produced because of the transformer feedback. The positive going grid voltage now draws grid current and discharges the step charge condenser. Immediately the positive grid voltage is removed and the tube is once again beyond cut-off. It is held beyond cut-off by the positive voltage applied to the cathode until another step charge is built up on the charging condenser. Consequently, a number of applied pulses are necessary to build up the charge on the condenser to a sufficient level to produce a burst of plate current in the blocking tube circuit. Thus the circuit serves as an efficient counter The actual count down can be adjusted to some extent by the potentiometer in the cathode circuit of the blocking tube. The more positive the cathode bias the more steps are necessary to build up the charge on the condenser to a level which will cause the tube to conduct. Again the voltage differential between the step levels becomes increasingly smaller as the number of steps and the charge level of the condenser rises.

A new circuit innovation discussed by C. E. Hallmark of *Farnsworth* at the I.R.E. Convention of 1947 permits a step voltage of equal increments to be developed across the charging condenser. With an equal increment step voltage on condenser C_2 count down ratios of twenty-five-to-one and higher can be expected. In a sync generator with this type of counter only two units, one with a twenty-five-to-one and a twenty-one-to-one count down ratio, are needed to count down from the double line frequency of 31,500 to the field rate of 60.

In this type of circuit, shown in Fig. 6B, the discharge or restorer tube is a

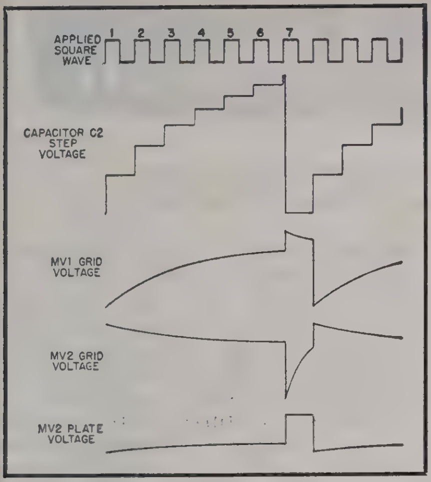


Fig. 7. Step counter waveforms.

triode and counter condenser C_1 is not permitted to discharge to zero during the negative alternation of the applied pulse. The level to which the condenser discharges is a function of the d.c. resistance of the triode. Inasmuch as the d.c. resistance of the tube is a function of the grid bias, this resistance can be varied. Thus, as the level rises across the condenser C_2 as it is step charged, the level to which C_1 is discharged also varies so that for each new positive alternation the charge added to C_2 is the same as the previous one. Thus, the step voltage increment on condenser C_2 between the 20th and 21st pulse is the same as it was between the 2nd and 3rd pulse. It is evident there is no more likelihood of the circuit jumping count at the 21st pulse than there is at the 2nd or 3rd pulse.

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Fink: "Principles of Television Engineering," McGraw-Hill Book Company.

Bedford & Smith: "Precision Television Synchronizing Generator," RCA Review, July, 1940.

Hallmark, C. E.: "Counter Timer for Television," Radio-Electronic Engineering Edition of RADIO NEWS, *July 1947.*

—30—

CASE FOR SMALL PARTS

SMALL repair parts commonly used in servicing radios, such as dial cord springs, fuses, nuts and washers are easily carried in a spectacle case as shown.

A small screwdriver and tweezers may also be carried in the case—which will fit in most any pocket . . . . H. L.

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AM-FM TUNERS

Covers the FM band from 88 to 108 MC. At 105-125 volts. 50-60 cycles, power consumption is 80 watts. Tubes: 9003 R.F. amplifier; 6BE6 oscillator-converter; 2—9003 I.F. amplifiers (456 KC); 6AL5 detector for the AM section. For the FM Section: 6AG5 R.F. amplifier; 6C4 oscillator; 6AG5 converter; 3—6AG5 I.F. amplifiers (10.7 MC); 2—9001 limiters; and 6AL5 detector. Two 6C4's are used for audio amplifiers, a 6U5/6G5 for tuning indicator and 5Y3GT/G for rectifier.

Now Available for Immediate Delivery. Write for Prices.

BROWNING
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Receives both old and new FM band (87 MC to 109 MC) and standard broadcast band (530 KC to 1650 KC). 115 volt 60 cycle operation. Tubes: one 6BE6, one 6CO4, one 6BA6, one 6SG7, two 7AG7, two 6SJ7, one 6H6, one 6SA7, one 6SF7, one 6E5 or 6U5 (tuning eye).
Net Price $143.90
POWER PACK for above 15.73

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Portable Radio. Recorder, and Public Address System. 7 tubes. High fidelity crystal-cutting head for 10" records. Excellent crystal microphone. Dual turntable speeds, 33⅓ and 78 r.p.m.

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1. Checks mutual conductance on a calibrated microohm scale, as well as on a REJECT-GOOD scale.
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4. Detects both shorted and open elements.
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IN TEST SPEAKERS

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Flate Face Pictures, 13 Channels.
Model 621TS— 7" Set....................$296.80
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Prices above include original RCA factory Installation in their service areas as well as guaranty for 12 months on the set and kinescopes. City sales tax where applicable added.

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Part No.		Price
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47202D1	Magnetic focusing coil for 5TP4, 10BP4, 15DP4 for use in series with divider	9.10
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47211T1	Horizontal output transformer with 9000 volt kick-back output for 2nd anode	16.85
47208T8	Horizontal blocking sync. discriminator transformer as used in RCA AFC cirq.	4.75
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47201R1	Horizontal width control for use with 7DP4, and 10BP4 or 15DP4	1.30
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47208T2	Vertical blocking oscillator transformer RCA	5.70
475218	FRAME with shatterproof glass and rubber mask for use with 12AP4 tube	8.00
475300	H.V. capacitor, .03 mfd 7500 volt working, grounded negative GE Pyranol	3.75
475301	H.V. capacitor, .1 mfd 7500 volt working, grounded negative GE Pyranol	7.50
475302	H.V. capacitor, 2x.1 mfd 7000 volt working, grounded negative GE Pyranol.	9.00
475303	H.V. capacitor, .05 mfd 16000 volt working, grounded negative Sprague	9.90
475305	TRANSVISION 7 inch Television Kit, all parts and tubes included	159.50
475306	Transvision 12" Television Kit	289.50
473007	Thordarson Transformer, 15000 Volt AC and filament winding as required	27.00

RCA HIGH FREQUENCY SWITCH AND COIL ASSEMBLY

RF unit, used in TRK12 RCA television receivers consisting of 5 band range switch with shield plate and mounting studs, including 5 polystyrene antenna coils, permeability tuned, each consisting of primary ring, secondary coil and primary mica capacitors. The assembly can be used in TELEVISION, F.M. and other HIGH FREQUENCY APPLICATIONS.

CATALOG No. 5210—Special price..............$5.60

RCA VARIABLE TUNING CERAMIC CAPACITOR

To be used in conjunction with the above switch assembly 2-4.5 MMFD.

CATALOG No. 5211—Price.......................$2.10

CATHODE RAY TUBES

Type	Make	List Price	Your Price
5BP1	DUMONT	$24.75	$ 7.95
5BP4	RCA	27.50	7.95
5CP1	PHILLIPS	24.50	7.95
5JP4	DUMONT	90.00	7.95
5TP4	Projection RCA	.....	67.50
7DP4	RCA	.....	14.95
7EP4	DUMONT	.....	23.25
7GP4	RCA	.....	24.25
9AP4	RCA	.....	62.50
10BP4	RCA	.....	49.50
12AP4	RCA	.....	75.00
15AP4	DUMONT	.....	129.50
20BP4	DUMONT	.....	270.00

All tubes are brand new, perfect, in factory sealed cartons, late production.

Send 50 cents for complete catalog including diagrams for RCA, G.E., Dumont, Andrea and Viewtone Television Receivers.

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264 WEST 40TH STREET NEW YORK 18, N. Y.
Phone PEnnsylvania 6-8730

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

EXCITER DATA

Columbus Electronics, Inc. have announced the availability of a new bulletin describing their FM Modulator Exciter Model FMO-428.

This unit which has been designed to serve as an e.c.o. exciter for amateur transmitters is featured in the bulletin, and, in addition, details of their high gain 6, 10, and 11 meter frequency converters are given.

A copy of Bulletin RN1 will be supplied by *Columbus Electronics, Inc.,* 229 So. Waverly Street, Yonkers, New York, upon request.

CHARATERISTICS CHART

A two-page chart titled "Basic Characteristics of Useful Industrial Laboratory Instruments" is now being distributed by *North American Philips Co., Inc.* to engineers, production control personnel, and manufacturers.

The data is presented in a convenient form and the chart may be hung on the wall for ready reference. The chart covers the apparatus or system, principle, basic arrangement, operation, application, comments, and manufacturers or suppliers.

Fifteen instruments are covered in the tabulation including colorimeters, cyclographs, electron microscopes, Geiger-Counter x-ray spectrometers, mass spectrometers, photometers, magnaflux, photelometers, spectrographs, etc.

Diagrams of the basic arrangement of the instrument being covered are also included.

A copy of the chart may be secured by asking for publication R-1066 from *North American Philips Co., Inc.,* 100 East 42nd Street, New York 17, New York.

RADIO AND INSTRUMENT KNOBS

Kurz-Kasch, Inc. has just issued a new catalogue, No. 103A, covering the company's line of standard radio and instrument knobs.

This 12-page booklet carries dimensions and construction details covering instrument knobs, pointer knobs, pointer and lever knobs, control knobs, terminal and control knobs, control balls, radio knobs, pointers, and headless setscrews.

Manufacturers are invited to submit their production requirements to the company. A copy of catalogue No. 103A will be forwarded upon request to *Kurz-Kasch, Inc.,* 1425 South Broadway, Dayton 1, Ohio.

AUTO RADIO ACCESSORIES

Servicemen who handle the installation and repair of auto radios will be interested in a new 8-page booklet just released by *J. F. D. Manufacturing Co.* of Brooklyn, New York.

Listed in the catalogue are cables, housings, fittings, connectors, radio control shafting, body plugs, wire-wound suppressors, antennas, and miscellaneous auto radio accessories.

Especially featured in this booklet is the company's "Remote-O-Cable Replacer" which is designed to speed auto radio repairs by providing, in a single unit, facilities for cable swedging, cable cutting, and fitting clamping.

A copy of this booklet may be secured from Dept. R, *J. F. D. Manufacturing Co.,* 4117 Ft. Hamilton Parkway, Brooklyn 19, New York.

UNIVERSAL PARTS CATALOGUE

A 24-page brochure covering universal electronic parts for distributors and radio servicemen has been announced by the Specialty Division of *General Electric Company's* Electronics Department.

The catalogue lists the price, specifications, and other data on sixteen parts in the division's line. Resistors, controls, antennas, the variable reluctance pickup, and loudspeakers are among the parts described.

A copy of catalogue ESD-93 may be secured from the company's distributors or by writing, Specialty Division, *General Electric Company,* Electronics Department, Syracuse, New York.

RIDER MASTER INDEX

John F. Rider, Publisher, Inc. has announced the availability of a new master index to the company's "Perpetual Troubleshooter's Manuals."

This "1947 *Rider* Master Index" covers all editions of the Manuals through Volume XV, which appeared in 1946, and includes the *RCA-Cunningham* and the Abridged I-V manuals.

The index is bound in paper covers and is in a companion size to the *Rider* Manuals. The price is $1.50 and may be obtained from *John F. Rider, Publisher, Inc.,* 404 Fourth Ave., New York 16, New York.

GCA BOOKLET

The *Bendix Radio Division* of *Bendix Aviation Corporation* has prepared a new non-technical booklet covering a step-by-step explanation of the function of ground controlled approach radar for landing planes safely in foul weather.

This 16-page booklet is well illustrated and the text material is presented with a clarity of style which would make the publication of interest to both laymen and persons working in the radio and radar field.

Copies of the booklet "What is GCA?" may be secured by writing *Bendix Radio Division* of *Bendix Aviation Corporation*, Baltimore 4, Maryland. Please address your requests to the attention of Mr. John M. Sitton.

H.F. CONVERTER BULLETIN

A four-page bulletin covering the line of high frequency converters manufactured by *Columbus Electronics Corporation* is now available for distribution.

Details and specifications on the company's Model HFC 610 for the 6, 10, and 11 meter bands; the Model HFC 101 for the 10 and 11 meter bands; and the Model HFC 106 for the 6 meter band are given, along with prices.

A copy of Bulletin C6 will be supplied upon request to *Columbus Electronics Corporation*, 229 So. Waverly Street, Yonkers, New York.

HYTRON TUBE CATALOGUE

Currently available for distribution, the four-page *Hytron Radio and Electronics Corp.* catalogue covering transmitting and special purpose tubes contains information of interest to those in the radio industry.

Engineering and operational data is provided in convenient tabular form on low-and medium-mu triodes, high-mu triodes, v.h.f. triodes, v.h.f. miniatures and acorn r.f. pentodes, transmitting beam pentodes and pentodes, rectifiers, and voltage regulators. Basing diagrams for the tubes are also given.

A copy of this catalogue will be sent to those requesting it from *Hytron Radio and Electronics Corp.*, 76 Lafayette Street, Salem, Massachusetts.

SERVICE DATA CHART

Sprague Products Company of North Adams, Massachusetts is now offering radio servicemen a giant wall chart for use in service shops.

Lithographed in color, this 22" x 28" chart carries handy service application data; diagrams and descriptions of common circuit troubles involving condensers and their remedies; general replacement data on electrolytics; formulas; transformer, resistor and condenser color codes; schematic symbols and other related information.

The wall charts are being distributed by *Sprague* distributors throughout the country and servicemen can obtain free copies from them on request.

HARDWARE CATALOGUE

The new two-color, 8-page hardware catalogue which is now being distributed by *General Cement Mfg. Co.* of Rockford, Illinois features a new patented "4 in 1" card which enables jobbers to display four items in the space normally required to display one item of merchandise.

The catalogue lists items by classification groups and almost 500 items have been included.

Copies of this catalogue are free

IT'S NEWARK for TOP QUALITY — BEST VALUE

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HALLICRAFTERS PANORAMIC ADAPTOR SP-44

Really Terrific! The famous Skyrider, sold everywhere for $99.50, now reduced at Newark to only $49.50. "Seeing Eye of Sending" is a 10 Tube Superhet, electronically-tuned, with self-contained scope—monitors up to 200 kc visually and analyzes signal characteristics from your own or other transmitters. Hooks into any rig. No Ham should be without one.

SP-44—Complete with tubes, for 115 VAC. Shpg. Wgt. 20 lbs. NOW . . . $49.50

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TZ40	1.88	826	1.50
2AP1	2.25	832A/832	2.25
2AP1A	5.25	836	1.13
2C26A	.75	837	2.25
2C40	.90	838	3.75
2C44	1.50	841	1.20
2V3G	1.38	843	.75
2X2/879	.90	845W	3.75
3AP1	3.00	865	1.50
3BP1	3.00	872A/872	2.25
3C24/24G	.75	874	1.95
3CP1	3.00	884	.75
3EP1	3.00	922	.68
3E29	3.00	923	.45
3FP7	3.00	931A	1.88
3GP1	3.00	954	.75
5AP1	4.50	955	.75
5BP1	3.38	956	.75
5BP4	3.38	957	.75
5CP1	3.38	958A	.75
5CP1A	6.00	959	.75
5LP1	9.00	1613	.75
6AK5	.90	1616	3.00
6D4	.45	1619	.75
7BP7	5.25	1624	.90
9JP1	2.25	1625	.53
10Y	.75	1626	.60
12DP7	6.00	1629	.27
12GP7	11.25	1641	.90
OC3/VR105	.75	1665/2050	.90
OD3/VR150	.75	1851	.95
211	1.13	2051	.53
304TL	3.75	7193	.45
316A	.75	8005	3.15
559	1.13	9001	1.05
801A/801	1.13	9002	.90
803	9.00	9003	1.05
807	.95	9004	.90
809	1.50	9006	.68

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Vibrator Power Supply. Efficient, Dependable. 12 volt DC Input. Output: 220-250 volts at 60 ma. Exceptional Buy! Size: 5½ x 2¾ x 6" H. No. S-460. Special $6.95

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Complete instructions for building your own television receiver. 16 pages—11" x 17" of pictures, pictorial diagrams, clarified schematics 17" x 22" complete schematic diagram & chassis layout. Also booklet of alignment instructions, voltage & resistance tables and trouble-shooting hints.—All for $1.00.

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Ideal for D.C. power district use, marine radio, or radar, etc. 115 volts D.C. input at 14 amps. 120 volts A.C. output at 10.4 amps. 60 cycles single phase. 1000 watts continuous duty. 3600 rpm. Centrifugal starter. Fully covered splashproof. Built to Navy specifications by the Allis Chalmers Co. Brand new. $87.50 f.o.b. Tuckahoe, N. Y.

230 volt input machines, same specifications also available............Price $125.00 f.o.b. Tuckahoe, N. Y.

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For you who want to build FM tuners or Television sets SPECOIL IF transformers enable miniaturization with correct band pass characteristics. Small, tuned from top, short leads to related components. New electronic principle. Circuit supplied free. Ask your jobber or write for catalog. List $5.95 each.

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THIS TAPE RECORDER-REPRODUCER is a completely self contained unit, having its own amplifier, speaker, and crystal microphone. One half-hour recording time on reel of magnetic tape which is erasable, reusable, and spliceable. For 110 v.-60 cycle.

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Oscilloscope, BC-1268, 5" C-R tube, contains 24 octal tubes	$27.50
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.1 mfd, 200 vwdc paper condenser, Micamold 345-21	5c
In lots of 50, each	4c
.5 mfd, 200 vwdc paper condenser, Micamold.	6c
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Antenna, MS-56, ¾" dia. x 37½" long copper plated steel tubing with mounting bushing. Suitable for dipoles, verticals, whips, beam elements, etc. Easily cut to length	19c
Microphone, T-24, carbon, hand type, American Microphone Co., for mobile rigs, etc.	$1.95
0-1 ma DC Meter, 3½" round, Weston 301	$4.25
Pilot Lamp, 1" dia. jewel, enclosed type, for S-6, 115v bulb, Dialco No. 9387, any color jewel. (Specify)	43c
Pilot Lamp, jeweled enclosed type, for bayonet base bulb, any color jewel. (Specify color).	19c
10-10-10-10 mfd, 4 sect. electrolytic, all 400 vwdc, Mallory FP can type	79c
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for the asking. Address requests to *General Cement Mfg. Co.,* 919 Taylor Ave., Rockford, Illinois or see your *GC* distributor.

LIMITING AMPLIFIER

The Transmitter Division of *General Electric Company's* Electronics Department has prepared a new 12-page booklet describing the company's Type BA-5-A limiting amplifier.

The new publication, complete with schematic drawings and diagrams, lists the operational and constructional features of the amplifier, a unit designed to increase the average program level of broadcasting and recording systems without danger of any audio peak exceeding a predetermined maximum value.

A copy of this booklet, EBR-99, will be forwarded to those making their request of the *General Electric Company,* Transmitter Division, Electronics Park, Syracuse, New York.

ENGINEERING DATA BOOK

The Superior Electric Company of Bristol, Connecticut is now releasing a 12-page bulletin on voltage control which will be of interest to designers and engineers.

Bulletin #547 features the latest developments in "Powerstat" variable transformers and "Stabiline" automatic voltage regulators. The material is presented in concise and easy-to-read form. Ratings, detail drawings, photographs, performance, and engineering data are included in the bulletin.

Copies of Bulletin #547 may be secured by writing *The Superior Electric Company,* 211 Church Street, Bristol, Connecticut.

—30—

Within the Industry

(*Continued from page* 30)

ments, and other factors pointing the way to greater efficiency, increased production, lower cost, and improved service in the induction and dielectric heating field.

* * *

ELECTROVOX CO., INC. has recently acquired a new and larger plant at 66 Franklin Street, East Orange, New Jersey.

General offices of the company will continue to be located at 31 Fulton Street, Newark, New Jersey until next year, at which time the offices will occupy space in the new building.

Branch offices in Chicago and Los Angeles will continue at their present locations.

* * *

ELECTRONIC LABORATORIES, INC. has recently acquired a plant in Harbor Springs, Michigan, for the manufacture of wood cabinets for the company's line of home receivers.

Logs are being cut on a 2000 acre property with all steps in the manufacture of these cabinets, from the felling of the timber to cabinet finishing, being performed by the *Wood Products Division* of the company.

* * *

P. R. MALLORY & CO., INC. has announced the removal of their New York Office to 41 East 42nd Street, Suite 1215.

The company, manufacturers of electrical and electronic components, has headquarters and main plants in Indianapolis, Indiana and branch plants in North Tarrytown, New York and Tipton, Indiana.

* * *

JAMES R. DONAHUE was elected President of *Arcturus Radio & Television Corporation,* a newly formed associate company of *Standard Arcturus Corporation of New Jersey.*

This new associate company will manufacture television receivers in the popularly priced field. Mr. Donahue, who has spent his entire business career in the radio and electronic field, was formerly Sales Manager of the parent company.

Announcement was also made of the appointment of John V. Rice, formerly associated with *National Union Radio Corporation,* to serve as Sales Manager of the Tube Division of *Standard Arcturus.*

* * *

MELVILLE RADIO INSTITUTE has recently moved to new offices in the Melville Building, 15 West 46th Street, New York.

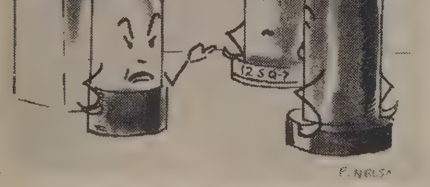
The Institute was formerly housed in quarters at 45 West 45th Street but the necessity for increased office space dictated the move to the new location.

* * *

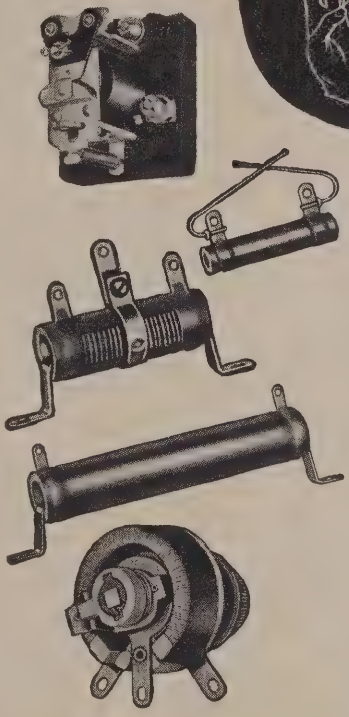
AIR KING PRODUCTS COMPANY has recently acquired an additional plant at 170 53rd Street, Brooklyn, New York, for the straight line manufacture of radio receivers.

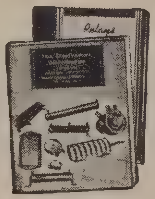
The new plant has 110,000 square feet of space and occupies a whole city block. The unit is air conditioned and lighted with fluorescent fixtures throughout. Belt gravity conveyors will be used to speed the larger components to the production line.

In addition to production facilities, the building contains offices, showrooms, and conference rooms. —30—



"Boy! Has he gone High Hat, since that last serviceman called him a Duo-Diode, High-Mu Triode!"





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Ward Leonard RESISTORS
Ward Leonard RHEOSTATS

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More Pages, Greater Detail, Drawings, Photographs, Designed for Good Performance, Simplicity, Economy. For Experimenters, Servicemen . . . any technicians that prefer to build their own.

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LOW-IMPEDANCE LOOPS

By HARRY R. HYDER

MOST broadcast sets use loops of the "high impedance" type; that is, a loop which contains all of the antenna inductance. While loops of this type are economical and adequate for small sets, they have some disadvantages. First, since the loop has a high Q, slight changes in its position relative to the chassis or other metallic objects make large changes in its inductance, making good tracking difficult to maintain. Thus, placing a loop set next to a radiator might upset its tracking seriously. Also, the high voltage across the loop, which is in close proximity to the set, causes undesirable coupling to other parts of the set, resulting in regeneration and instability. This is why some sets have an aluminum baffle between the loop and the chassis.

A much better scheme, particularly for a console set, is to use a "low impedance" loop. This is a loop of large physical dimensions but which has very low inductance, usually about 10 microhenries, or 5% of the required antenna inductance. Since it is but a small fraction of the antenna inductance, capacitance and inductance variations will have little effect on the tuned antenna circuit as a whole. Also, since the voltage across it is low, coupling to other parts of the circuit will be low. There are two methods of coupling the low-impedance loop to the grid of the first stage. The first method is to use a low-impedance, primary-tuned secondary r.f. transformer; but this is a special coil and they are not currently available. A far simpler scheme, which is just as effective, is to place a loading coil in series with the loop (Fig. 1) and feed it directly to the grid of the tube. The only requirement of the loading coil is that it have enough inductance to make up the difference between the required inductance and the inductance of the loop, and have a reasonable Q. One can be made from a standard "Universal Adjustable" replacement antenna coil. These have iron slugs, permitting the inductance to be varied over a range of about 20%. Several standard types were measured and found to average about 125 in Q. The best one had a progressive-universal wound Litz wire secondary and had a Q of 150 at 1 mc. The primary was removed from the form and it was wired as shown in the diagram. The slug makes adjustment of inductance for tracking very simple and precise. This is the procedure; with the loop and loading coil wired as shown, tune in a weak station near 600 kc. and adjust the slug for maximum volume. Then tune in a weak signal near 1400 kc. and adjust the antenna trimmer on the tuning condenser for maximum volume. Repeat these two adjustments in the same order, and the set is "tracked." The weaker the signals used, the more accurate will be the adjustments.

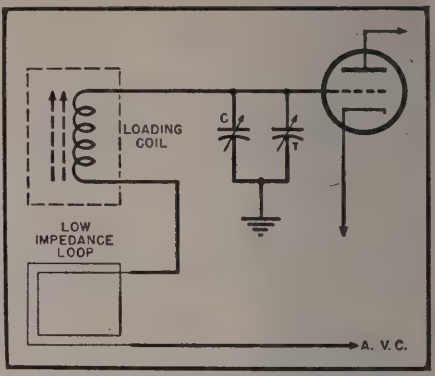

Fig. 1

In actual measurements on one set, the sensitivity with the low-impedance loop was greater than with a high-impedance loop having an operating Q of 100. In addition, noise, instability, and lopsided selectivity, all due to regeneration, were completely eliminated. Also, the tracking "stayed put."

The loading coil was mounted in its shield can on the chassis. The low impedance loop consisted of 2 turns of No. 16 hook-up wire, spaced 2 inches between turns and stapled to the inside of the console. Its exact dimensions are unimportant, but it should have as large an area as possible, for maximum signal pickup.

—30—

The 829-B and 832-A

(*Continued from page 60*)

former. Column 3 are the values obtained by using an 832-A tube in place of the 829-B.

Because of the results obtained in the experiment, it is believed that many amateurs will find uses for these two tubes in audio amplifiers. A very compact transmitter could be built by using an 829-B in the final r.f. amplifier with 90 watts input and modulating it with another 829-B with 500 volts on the plate.

—30—

Table 1. Operating characteristics of the 829-B and 832-A tubes at audio frequencies.

	829-B	829-B	832-A
Plate Volts	500 volts	315 volts	315 volts
Screen Volts	225 volts	225 volts	250 volts
Plate Current	200 ma.	150 ma.	108 ma.
Screen Current	25 ma.	26 ma.	12 ma.
Cathode Voltage	19.5 volts	16 volts	20 volts
Cathode Resistor	100 ohms	100 ohms	200 ohms
Undistorted Output	43 watts	20 watts	10 watts
A.F. Voltage for Undistorted Output	16 volts	10 volts	16 volts
Maximum Output	65 watts	29 watts	18.5 watts
A.F. Voltage for Maximum Output	22 volts	16 volts	25 volts
Plate Impedance	10,000 ohms plate-to-plate in all cases.		

Technical BOOKS

"THE FUTURE OF TELEVISION" by Orrin E. Dunlap, Jr. Published by *Harper & Brothers,* New York. 190 pages. Price $3.00.

When the author published his "The Outlook for Television" in 1932, the book covered past developments in the television field. This companion book, while outlining some of the great achievements in the field, goes beyond the present for a good look at the future of the medium.

In spite of the nebulousness of the future of television, this book is definitely not in the "crystal ball" category. The author, who is on the executive staff of *Radio Corporation of America* and was, for almost twenty years, radio editor of *The New York Times,* is in a strategic position which allows him to survey both the pros and cons, the acceptance or non-acceptance of the public, competition with movies and other entertainment media, and the type of programming concept which will provide commercialization of television.

While the book takes the technical side of television performance for granted, the author has raised many pertinent and important problems which the prospective station owner, program director, staff, and the public must take into consideration in the production and reception of this medium.

A valuable appendix which lists important dates in the development of television and video programming, and a list of American television stations, by channel, complete this projection into the future of the video art.

* * *

"TELEVISION TECHNIQUES" by Hoyland Bettinger. Published by *Harper & Brothers,* New York. 229 pages. Price $5.00.

Since many of the new television stations being constructed in the country will demand complete versatility of its employees, this book on television techniques should find wide acceptance among those involved with the technical aspects of the transmission as well as those whose work deals with the programming and planning of video entertainment.

The author, who is a consultant on television programming and production, was formerly Program Manager of the *General Electric* station, WRGB, in which position he had wide experience with the various experimental video techniques. This book, based on the author's knowledge of the problems confronting a TV station staff, is a completely practical handbook.

The text material has been lavishly illustrated and the reader should experience no difficulty in visualizing the problem and its solution. The author has covered television equipment in a

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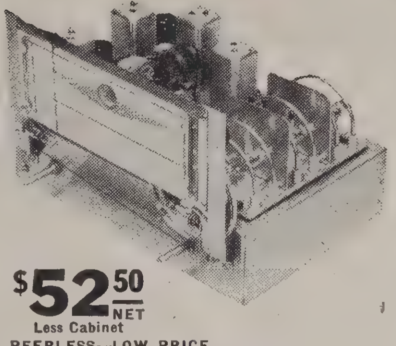

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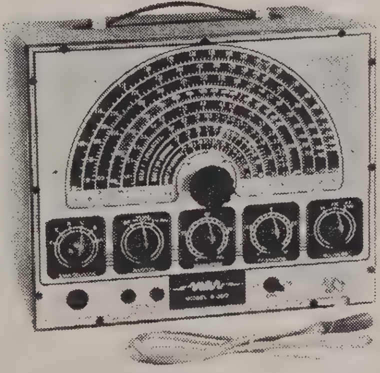

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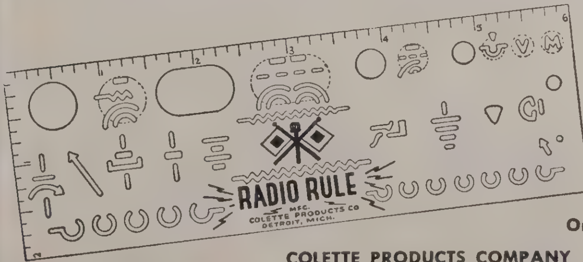
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non-technical manner, explained some of the problems inherent in the medium, and then discussed pictorial composition and continuity, video techniques, audio techniques, television writing, directing and producing, the production of a play, motion pictures and film integration, and finally, television lighting.

For those looking forward to a career in telecasting, this book should provide a thorough and complete understanding of the techniques involved in producing a "bang-up" show.

* * *

"TELEVISION," (Volumes III and IV) edited by A. N. Goldsmith, A. F. Van Dyck, R. S. Burnap, E. T. Dickey and G. M. K. Baker. Published by *Radio Corporation of America.* Price $2.50 each. Paper edition, $1.50 each.

These two volumes, the first to appear since the war, cover television advancements in the period 1938-1941 (Volume III) and 1942-1946 (Volume IV). These books are a compilation of technical papers written by *RCA* staff members on television and associated equipment and techniques.

Volume III is divided into three main sections covering pickup, transmission, reception, general topics, and summaries of articles of interest. Volume IV covers pickup, transmission, reception, color television, military television, general topics, and summaries of articles dealing with special phases of television.

The material, in general, is technical in nature and should be of particular interest to engineers working in the field. Problems involved in television sound transmission, transient response, light valves, projection optics, wideband amplifiers, local oscillator radiations, etc., are discussed at some length. Mathematics are used freely throughout the text providing a solid technical background for the solution of the problems under discussion.

Representing as they do, the combined efforts of *RCA's* technical staff, these books should find wide acceptance among television engineers and those concerned with the commercial transmission of video signals. —30—

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International Short-Wave

(*Continued from page* 116)

English announcements at 1500. (Pearce)

Macao—CR8AA, 9.254, is heard in Australia at 0600 with music, chimes, then news in Portuguese; QRM bad. (Sanderson) Heard poorly lately in New Zealand, news at 0650; Macao is verifying old reports (as far as 2-3 years back) with nice card. (Cushen) According to *Radio Australia,* uses 200 watts, and is scheduled 0430-0930; QRA is Post Office Building, Macao, Portuguese China. (Beck)

Malaya—A letter received by *"The Broadcaster,"* Perth, from the British Far Eastern Broadcasting Service, Singapore, stated: "You will perhaps be interested to know that there are two entirely separate broadcasting authorities in Singapore. One is *'Radio Malaya,'"* which is a Colonial Government Department serving both Singapore Colony and the Malayan Union; the other is the British Far Eastern Broadcasting Service, which is a Foreign Office station serving *non-British* territories throughout the Far East and relaying the Eastern, Far Eastern and Overseas Services of the BBC. The frequencies in use for this Service are 15.300, 15.275, 11.735, and 6.770—from 0330 to 1200 on the two former frequencies and from 0325 to 1200 (EST) on the latter two frequencies." The 15.300 outlet is heard in Australia with news at 0415. (Sanderson) Heard in Britain with news at 1145, signing off with "God Save the King" at 1200, saying back at 0030. (Brownson)

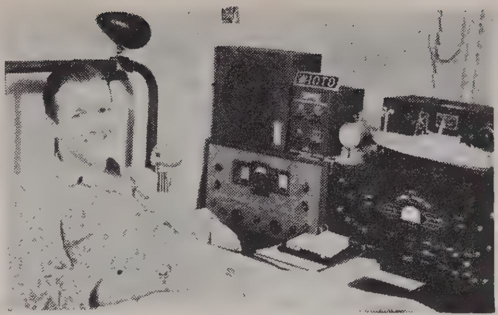
Radio Malaya uses 620 kcs. and 4.825 on s.w., and relays over Radio Kuala Lumpur, 6.045; broadcasts in *English,* Malay, Chinese, Tamil. (Cushen)

Radio Kuala Lumpur, 6.045, is scheduled 0530-1030, except Saturday when runs to 1130. (NZDXC) Has news at 0600. (Sanderson) This is relayed from Singapore; carries news from own studios 0800. (Cushen)

New Guinea—Jungle Network, Biak, has been heard in California around 0450 to about 0635 on 7.198 (approx.); heard closing with "Gut Abend, Gut Nacht and Happy Landing." Plays American popular recordings. (Dilg)

Northern Rhodesia—ZQP, Lusaka, uses 3.914, 7.220 (actually appears to be as high as 7.285), and 9.705; latter with 2.5 kw., others 500 watts; daily official schedule is 1030-1200 for Africans, with *English* announcements; Sunday schedule is *English* program at 0400-0530, news at 0400. (Laubscher) Heard irregularly on West Coast, coming on at 1030 with drums. (Dilg, Baxter) It is possible by this time that ZQP will have changed schedule, to commence by 1000 or perhaps even as early as 0930.

Norway—LKJ, 9.54, Oslo, is heard in Australia at 1645 with news in Norwegian and music; LKQ, 11.73,



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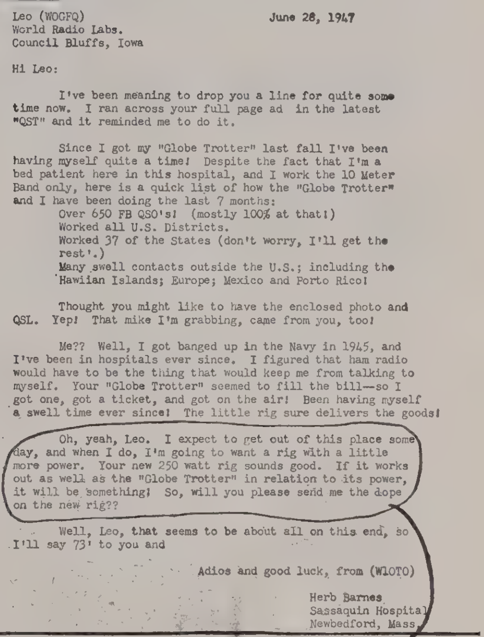

Leo (WOGFQ)
World Radio Labs.
Council Bluffs, Iowa

June 28, 1947

Hi Leo:

I've been meaning to drop you a line for quite some time now. I ran across your full page ad in the latest "QST" and it reminded me to do it.

Since I got my "Globe Trotter" last fall I've been having myself quite a time! Despite the fact that I'm a bed patient here in this hospital, and I work the 10 Meter Band only, here is a quick list of how the "Globe Trotter" and I have been doing the last 7 months:

Over 650 FB QSO's! (mostly 100% at that!)
Worked all U.S. Districts.
Worked 37 of the States (don't worry, I'll get the rest'.)
Many swell contacts outside the U.S.; including the Hawiian Islands; Europe; Mexico and Porto Rico!

Thought you might like to have the enclosed photo and QSL. Yep! That mike I'm grabbing, came from you, too!

Me?? Well, I got banged up in the Navy in 1945, and I've been in hospitals ever since. I figured that ham radio would have to be the thing that would keep me from talking to myself. Your "Globe Trotter" seemed to fill the bill—so I got one, got a ticket, and got on the air! Been having myself a swell time ever since! The little rig sure delivers the goods!

Oh, yeah, Leo. I expect to get out of this place some day, and when I do, I'm going to want a rig with a little more power. Your new 250 watt rig sounds good. If it works out as well as the "Globe Trotter" in relation to its power, it will be something! So, will you please send me the dope on the new rig??

Well, Leo, that seems to be about all on this end, so I'll say 73' to you and

Adios and good luck, from (W1OTO)

Herb Barnes
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Hallicrafters HT-9	350.00	70.00
RME VH-F-152	86.60	17.32
RME-84	98.70	19.74
RME-45	198.70	39.74
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WRL exciter unit wired	23.95	4.79
Millen 90800 exciter	42.50	8.50
Sonar XE-10 transmitter	87.45	17.49
Workshop 28 megacycle beam 3 element	39.50	7.90
Workshop 6 element 28 megacycle type	100.00	20.00
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heard at 0145 with news in German and musical program, 10 notes on piano as interval. (Sanderson)

LKV, 15.170, Tromsoe, heard in Britain from 1100 in parallel with other outlets; has news in Norwegian at 1600; no *English;* power 10 kw. according to airmail QSL.

Panama—Schedule of HP5H, 6.122, Panama City, is now 0630-000. (Beck)

Paraguay—ZPA-5, 11.948, Encarnacion, logged through terrific CWQRM from 1755 to sign-off at 1840; news in Spanish at 1830; signal fluctuated considerably. (Kary)

Philippines—KZRH, 9.640, Manila, is heard with fair to good level in the East early mornings; news 0530. Miss Sanderson, Australia, reports program details at 0415. Cushen, New Zealand, says is in clear there now 0000-0400, since BBC removed GVZ from Pacific Service.

Poland—Warsaw, 6.11, during summer has had news at 1450 instead of 1550 as was the case in winter.

Siam—Bangkok, 6.125 (or 5.990, alternating), is heard to 0630 and again to sign-off at 0915. (NZDXC) News is scheduled for 0615.

Sierra Leone—Freeton, 8.125, reported heard Sundays *only,* beginning 1530. (Harrison) May be using a 19-m. frequency also; I understand this station wants reception reports.

Surinam—PZR, 11.332, Paramaribo, "Avros, Paramaribo," is being widely heard, late afternoon and evenings. Announces in Dutch and plays many American popular recordings.

Sweden—An order has been placed with a British radio concern for two 100-kw. transmitters for the new s.w. station at Horby, at a cost of 1.9 million kroner; these stations are expected to be ready for operation in two or three years.

Switzerland—Regularly scheduled transmissions from the *United Nations Radio,* Geneva, should be on the air shortly; has been conducting experimental transmissions for some months now. Reports should be addressed to Robert Nivelle, in Charge of Radio, Information Centre, European Office of the United Nations, Geneva, Switzerland.

Berne's HER7, 17.784, opens at 0955 with usual chimes; man announces (in *English*) at 1000 as operating on 15.305 and 17.784; woman then begins Swiss home news in *English;* 1100-1159 French is used; signs *off* then with march. (Kary)

Turkey—Cavad Memduh Alta, director, Radio Branch, Turkish Press Department, Ankara, advises Paul Kary that TAQ, 15.195, normally does *not* carry *English,* but it is used at times for relaying American correspondents to U.S. networks; has been so heard by Kary at 0800-0815; Ankara verified his reception of TAQ.

U.S.S.R.—Best heard lately in Moscow's North American beam, 0745-0815, mornings, and 1820-1950, evenings, are 17.839 and 15.170. Other morning frequencies include 11.75, 15.11, 15.23, 21.55. In the evening,

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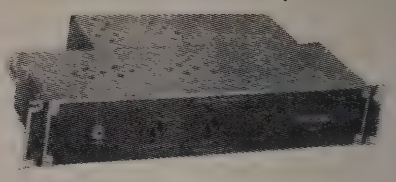

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Same but 2500-ω. #R29	.95
Clare SPDT, 3500-ω, 6-ma. #R30	.79
Guardian SPST Norm Open, 40-ω, 6-Volts. #R31	.49
Edison Thermal Time Delay, SPST Norm Open, 110-v, a-c or d-c, 45 sec start, 10 amp contacts. #R32	1.39
Allen Bradley Solenoid, SPST, Norm Open, 200-ω, 24-v, 50-amp contacts. #R33	.79

CHOKES

Raytheon, 25-H, 30-ma, 850-ω, 2¼x2¼x2½ 4000-v insul. #T32	$0.69
General Trans, 11-H, 40-ma, 350-ω, 2" diam x 2½. #T33	.59
Westinghouse, 4-H, 90-ma, 300-ω, 2" dia x 3". #T34	.59
G.E., 325-T, 5500-ω, plate chk, 1¾x2½x1¾h. #T35	.59
Potter, 25H, 30 ma, 400-ω Center Tpd, 2" dia x 4". #T36	.95

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Output, PP 2A3 Cls A or PP 6L6 Cls AB2 to 1.5, 3, 5, 8, 15; UTC P.A. Series. #T37	$2.95
Cls B Intrstge; Driver Plate to PP grids upright shielded type. #T38	1.59
Audio, 4:1, 2¾x2⅛x2⅞ Ferranti. #T39	.75
Mike or line to grid Ferranti 2¾x2⅛x2⅞. #T40	.75

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Made for E. H. Scott's Navy Model REE entertainment receiver. Imp: pri 4400 ∼ ct; sec's 4, 60 ct, 200, 300, 600 ∼. Fully cased. 5 lbs. Matches push-pull 6L6's, 25L6's, 50L6's. Tested at 18 watts power output into 4 ∼ load, O.K. Excellent transient response; with 1,000 cps square wave input at 20 watts, input and output waveforms look exactly alike on scope. Can also be used for remote speakers, 600 ∼ winding to line, 4 ∼ to voice coil. 60 ∼ winding used to provide inverse feedback voltage. With each order will include schematic of the REE's power supply and audio section which is flat (± 2db) 70—10,000 cps. (The 70 cps figure is not due to the transformer, which is flat down to 20 cps.) Tell your friends about this ad. Quantity limited. Order immediately!

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paralleling are 11.89, 15.23, and others, irregularly.

Komomolsk, Khabarovsk Territory (Siberia) has recently been heard in British Columbia on 9.565 at 1545, with news in Russian at 1600; clock heard striking, followed by station announcement: "Gavoritt Khabarovsk" (or "Talking Khabarovsk"). (Verigin) RV64, also Siberia, heard back on summer frequency of 8.820 where has strong signal in British Columbia, but distortion is as bad as ever. (Park)

* * *

Last Minute Tips

Direct from Carl Etienne, HHCN, Port-au-Prince, Haiti, comes word that HHCN, Station de Radiodiffusion, began operations July 15 on 5.660 with daily schedule of 1700-2100, power 100 watts. Announcements are made in French, Spanish, and *English*. "We will verify all reception reports," says Mr. Etienne, who gives "correct" address as Station HHCN, Avenue Christophe No. 55, Port-au-Prince, Haiti, W. I. Additional information given by Mr. Etienne is:

"The latest and most prominent news in broadcasting in Haiti is that the Chamber of Deputies just approved a law introduced by the Executive and upon which broadcasting over 5 kw. will be a State Monopoly. Except in Port-au-Prince, the Capital city, where four s.w. stations operate (HH2S, 5.945; HH3W, 10.105; HHCM, 6.160; HHCN, 5.660), only Cap-Haitien has one, HHCP, working in the 40-meter band— totaling less than 2 kw. There are also three long-wave stations in Port-au-Prince. In all Haiti there are about 3000 radio receivers. Haiti has an area of about 29,536 square miles and is bounded on the east by the Dominican Republic. The population is about 3,500,000 people. Port-au-Prince has a population of about 250,000. Haiti is an agricultural country. Principal crops are coffee, bananas, corn, rice, sugar, cotton, cacao, and sisal. There are very few industrial plants."

From A. Cross, of the Trinidad Broadcasting Company, Ltd., Broadcasting House, Port-of-Spain, Trinidad, B.W.I., comes this word: "Just now we are off the air due to a breakdown of the modulation transformer and we await replacements from the States due August 15. Our station is due to open *officially on* August 31 if there is no further delay on this replacement transformer." (Ferguson) Watch for this station with call of VP4RD on 9.635 around 0600 and on 6.085 around 0635 for tests.

We have just received a flash from a reliable source that a new outlet of the Spanish-speaking countries is in the making, with transmitting equipment to be located on Fernando Po Island, off the West Coast of Africa. Our informant reports: "Boasting a power of 200,000 watts, the antenna will be a 4-beam unit, beaming programs to Europe, North America, South America, and the Far East. *Programming will be in all languages.*

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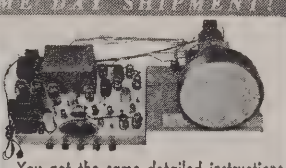

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New advanced television receiving circuit uses only five control knobs for perfect picture and high fidelity F.M. sound. Comes complete with high quality parts (famous brand names!) pre-tuned I.F. coils, punched chassis, wire, hardware and easy-to-follow instructions. Three fixed-tuned bands. Tubes required: 1—6J6, 1—5U4G, 1—2X2/879, 1—6V6, 1—XXFM, 6—6SN7, 5—6AC7/1852, results assured! For operation on 105-125 volts, 60 cycles, AC.

#7 TELEKIT, complete, but less tubes and cabinet	77.50
Complete kit of matched tubes, including RCA 7GP4 7" picture tube	39.95
Cabinet for above kit, walnut finish	22.50
Front Panel only (not required if cabinet is ordered)	10.00

10" *Electro-Tech* TELEKIT

The 10" Telekit incorporates the new TTI interlock circuit for horizontal and vertical sync control. Features include 5 bands, electromagnetic scanning and focusing, pre-tuned I.F. coils, 9500 volt power supply for 10" tube, two separate low voltage power supplies, high fidelity F.M. sound. Only five control knobs used. Tubes required: 1—6J6, 1—XXFM, 1—6V6, 1—6AC7/1852, 4—6AG5, 5—6SN7, 1—6BG6 or 807, 1—5V4G, 1—1B3GT/8016, 2—5U4G, 1—10BP4. Complete with all parts, punched chassis, wire, hardware and easy-to-follow instructions. For operation on 105-125 volts, 60 cycles, AC.

#10 TELEKIT, complete, but less tubes and cabinet	124.50
Complete kit of matched tubes, including RCA 10BP4 10" Bright Picture tube	65.35
Cabinet for above kit, walnut finish	29.50

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Focus coil, type 202D1	5.34
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Horiz. output transformer, 204T1	13.52
Horiz. output transformer, 204T3	8.56
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RCA 12AP4	75.00
DuMont 20BP4	275.00

Horiz. output transformer, 211T2	13.38
Vertical output transformer, 204T2	5.29
Horiz. bl.-osc. transformer, 208T1	3.53
Vertical bl.-osc. transformer, 208T2	3.35
Horiz. bl.-osc. transformer, 208T3	2.67

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Universal mtg. brackets for above kits, type 227, per pair	4.41
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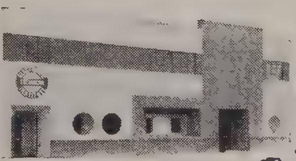

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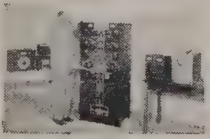

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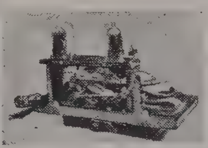
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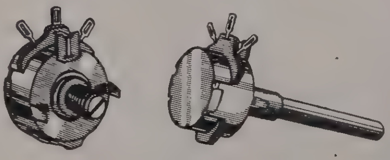

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Daytime operation will be in the 20-30-m. vicinity, shifting to about 50 meters for night operations. The station identification is as yet unknown, but it is expected to be on the air by the autumn of 1948. Sponsoring the station is Compania de Radiodifusion Intercontinental, well-known in Spanish broadcasting circles."

Vatican—During the summer, HVJ, *Radio Vatican*, has been audible some days on 15.095 during the 0900 news period; at times is buried by Monreal's 15.090 outlet. Announces 9.660 in dual, and that 9.660 and (about) 5.971 are used for a further (*English*) period 1315-1330 daily. During the winter the morning news from HVJ will be heard one hour later, 1000.

The 9.660 frequency is heard in Britain signing *on* at 1245 with a program in German; *English* at 1315, as scheduled, announcing (about) 5.971 in dual. (Pearce)

* * *

The National Catholic Welfare Conference, Washington, D.C., has been given permission to reprint the story on Vatican Station HVJ (June ISW Department). A dispatch commenting on the article was released by NCWC to the Catholic press, also.

KZPI, Manila, has been using 9.695 instead of 9.710 for some time now; signal seems improved, may have increased power. (Dilg) Heard in New Zealand at 0445, stating that *all reports will be verified.*

Beira still appears to be on 7.155 although in verifying gave frequency as 7.255; the QSL card they send is white with dark red and green stripe (national colors, probably), corner to corner, diagonally. Data on card is in black; actual verie portion is in Portuguese; it is suggested that collectors specify the QSL card or may get *only* letter-verie; it would be well to enclose IRC. (Laubscher) Mr. Laubscher was informed—from QRA of CR7IB, Emissora do Aero Clube da Beira, P.O. Box 3, Beira, Mocambique—that this station has "made appeals to listeners to inform us on the reception of our stations, for we now wish to know for certain how far our stations can be heard, for future transmissions." It was further stated that this request was made after receipt of several reports from ISW monitor Sidney Pearce in England that the station was being heard well there.

Hongkong's ZBW has had an improved signal lately on West Coast; appears lower in frequency, around 9.510, where is in clear of Perth's VLW7, 9.520. (Dilg) I have been hearing a station on this channel around 0630 with Chinese that is *possibly* Hongkong. Miss Sanderson, Australia, reports ZBW at 0445 with BBC relay and music.

Kary, Pennsylvania, reports that on occasion, XGOY's 11.913 outlet (scheduled to close at 0530) has been heard recently as late as 0645; location Chungking.

A "new" Indonesian has been logged

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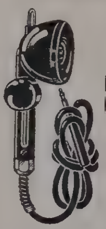

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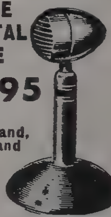

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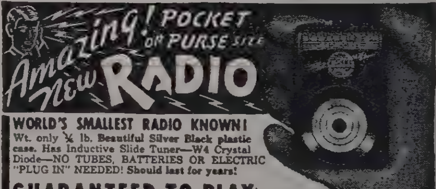

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LCETI

on about 6.600 with an *English* period, 0530-0630. (Dilg)

Radio Sofia, Bulgaria, is sending out a new QSL depicting a map of Bulgaria. Still has news at 1530 on 9.350 and closes at 1540; asks for reports to Radio Sofia, Anglo-American Service, Sofia, Bulgaria. (Pearce)

A Chinese station heard for some time on about 7.100 with call sounding like XGAF or XGOF, now seems to have a dual outlet on about 11.675; at 0800 now gives some news (in *English*), "read by an American *who is in a hurry;* he says it is the U. S. Radio Service in Los Angeles with United Press releases." Chinese and western type music alternate at times; once at 0700 carried an oration (in Chinese), same program as on XTPA, 11.65, Canton, and XORA, 11.725, Shanghai. (Dilg)

A French-speaking station has been picked up in California, mornings, on about 9.470; heard with *English* at 0715, ending with "Good night, everybody," followed by talk in French. (Dilg) May be a Hanoi outlet.

CE-1180, Radio Sociedad Nacional de Agricultura, Casilla 40-D, Santiago de Chile, verified a report sent in Spanish with QSL in *English.* (Bachman)

In a more recent DX broadcast, *Radio Australia* gave "revised" schedule of ZQP, 9.705, Lusaka, Northern Rhodesia, as 1030-1130 on Sundays, 1030-1200 on weekdays.

Tananarive, Madagascar, 9.695, heard on West Coast signing *off* at 1245, S4, signal. (Nankervis)

* * *

Acknowledgement

Many thanks for the fine reports coming in. They should be mailed to reach your SW editor at 948 Stewartstown Road, Morgantown, West Virginia, U. S. A., by the *sixth* of any month. Monitor cards for 1947-48 are being sent out to all *active* reporters, and new monitors will be welcome from any place in the world. ... K.R.B.

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NEW RECEIVERS for Fall Market

PORTABLE RADIO

Arc Radio Corporation of Brooklyn is currently in production on a new small sized portable receiver known as "Porty No. 601."

This receiver which weighs only 72 ounces and measures 7½" x 9½" x 3" is bound in leatherette in different styles and colors. An adjustable matching strap for shoulder or hand carrying makes this unit particularly adaptable for travelling.

Fingertip control of volume and station selectors plus a 4" PM speaker are special features of this receiver. Although designed as an "individual" receiver the unit provides sufficient volume for group listening.

Arc Radio Corporation of Brooklyn, New York will supply further information on "Porty No. 601" upon request.

COMBINATION UNIT

Electronic Laboratories, Inc. of Indianapolis have recently added a new 10-tube console radio-phonograph to their line of home receivers.

This new unit, which is available in mahogany, walnut, or blonde finishes, incorporates two speakers and two separate amplifiers for individual tone control. An automatic intermixed 10 or 12 inch record changer is used and storage space for 10 albums or 120 single records is provided.

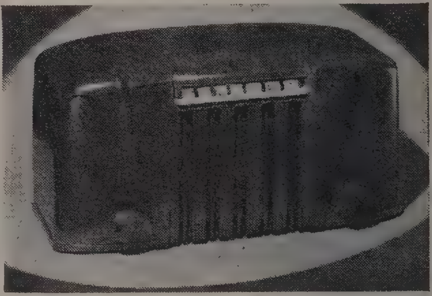
Additional features of this new receiver include push-pull output, dual speaker system, superheterodyne circuit, a.v.c., and the company's new vario-tuner. A built-in antenna is also provided. Standard models are for operation on 105-120 volt, 50-60 cycle a.c. while special d.c. models to operate on 105 to 120 volts will be available at a slightly higher cost.

Electronic Laboratories, Inc., Indianapolis, Indiana will supply additional details on request.

TABLE MODEL

In response to consumer demand for a low-priced radio, *Garod Radio Corporation* has introduced the "Ensign," an a.c.-d.c. table model receiver.

Designated as the Model 5A1, this table model utilizes four multi-purpose tubes plus a rectifier. A built-in loop antenna and slide-rule dial with full standard broadcast calibration from 540 to 1650 kc. plus the newly developed *Garod* Alnico speaker, are added features of this radio.



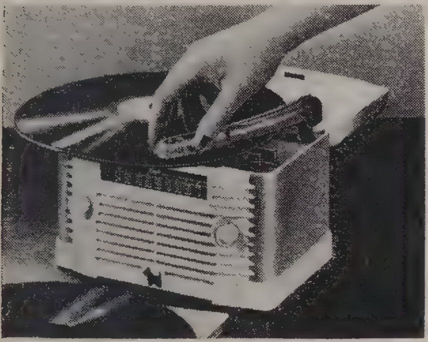
This model is available in either walnut or ivory plastic. *Garod Radio Corporation,* 70 Washington Street, Brooklyn 1, New York will supply complete information on request.

"SCOTTIE CONVERTIBLE"

Currently being released to dealers, the new 1948 *Remler* "Scottie Convertible" incorporates several unique features.

Designed to meet the demand for a moderately priced radio-phonograph, this unit measures 6¾"x7"x10". The phonograph features a constant-speed, worm-gear drive and both turntable and motor are mounted in rubber to eliminate vibration. Either 10 or 12 inch records may be played. Three watts output in both phonograph and radio insure adequate volume for most applications. A single knob controls the volume for both radio and phonograph.

The phonograph shuts off automatically when the lid is lowered, while the radio can be used with the phonograph section either open or closed.



The Convertible is available in either ivory and ebony or in an all-ivory deluxe model which is equipped with a silent tone arm. A zippered carrying case is available for easy portability.

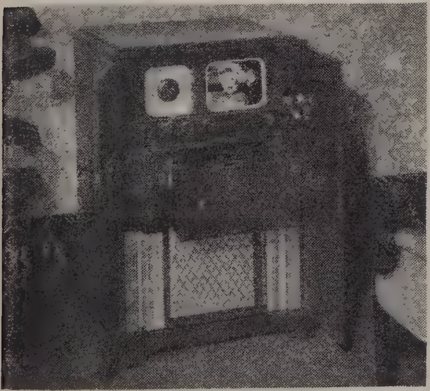
Further information will be supplied by *Remler Company, Ltd.*, 2101 Bryant Street, San Francisco 10, California.

DIRECT VIEW TV UNIT

General Electric Company recently introduced their new direct view television receiver to the trade.

This unit which includes both AM and FM radio and an automatic record player in addition to television reception has been designated as the Model 802.

The receiver uses a 10 inch cathode-ray picture tube and incorporates a separate circuit for each of the 13 television broadcast channels which can be selected by merely turning a rotary switch to the desired channel.



The automatic clarifier, used in this receiver, provides sharp, clear pictures, reduces interference materially and virtually eliminates fuzzy picture edges, according to reports from the company.

General Electric Company's Receiver Division, Bridgeport, Conn. will provide full details on the Model 802 upon request.

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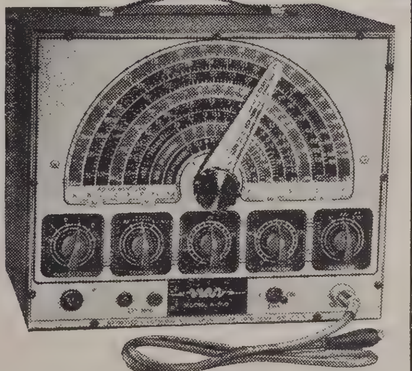

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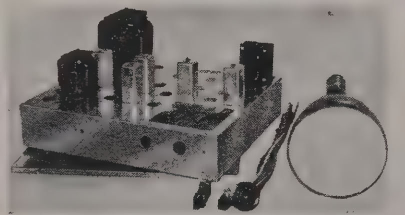

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V.F.O. Exciter

(*Continued from page* 51)

ing since the VR150 and additional dropping resistors and bypasses following the filter proper deliver pure d.c. The filament transformer for the HY615 is a separate job of 3 amp. rating and it feeds no other tubes. The other power supply is a simple one using a 250 mil. transformer with a suitable filament winding for the 6L6 and the 1852 (6AC7) stage. A single input choke and a 4 μfd., 600 v. oil-filled filter is sufficient for these stages. The two line chokes and the four line bypasses shown in the rear center of the under-chassis are a very necessary and effective means of keeping the r.f. where it belongs. These, plus good bypassing and r.f. chokes in all critical places in the unit, good grounding, and over-all shielding will insure trouble-free performance.

The exciter delivers a beautiful clear note down to and including 10 meters. Stability is excellent. Tests made with a local monitoring station showed no sign of hum, r.f. feedback, or instability on ten meters.

All in all, the ability to pick any spot, in any of the four bands from 10 to 80 meters, with ease and speed made the time and effort expended on building this exciter well worthwhile. —30—

A BETTER CLICK FILTER

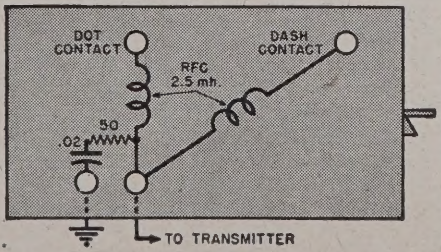
By J. D. GALLAGHER, W5HZB

SINCE key click filters are used to reduce the interference caused by sparking at the contacts of the key or bug, it is best to place such filters as close to the source of interference as possible—usually at the key or bug terminals. Another very good method of reducing this type of interference is shown in the accompanying diagram.

First remove the wires connecting the dash and dot contacts to the ungrounded terminal. Connect one r.f. choke from the dash contact to the "hot" terminal, then another r.f. choke from the dot contact to the "hot" terminal as shown in the diagram. Make these leads as short as possible. Place a 50 ohm resistor on the "hot" terminal and in series with it place a .02 μfd. condenser to the grounded terminal of the bug.

This is not a new method of removing interference caused by sparks at contacts, but it is a good one. Some high speed teletypewriters use a similar arrangement to reduce interference in nearby receivers. —30—

Wiring diagram for key click filter.



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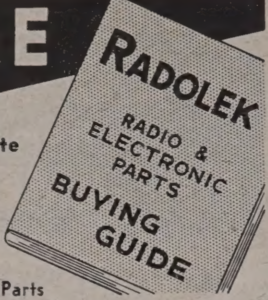

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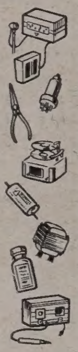

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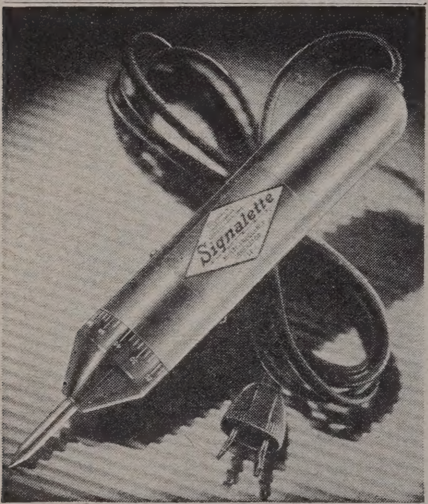

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Spot Radio News

(Continued from page 20)

$39,637,427. "During the first four months of 1947 alone," the Commerce analyst points out, "exports totaled $31,175,055—more than five times as much as in the corresponding period of 1946 and equalling 85 per-cent of the total for the entire year 1946. If exports should continue at the same rate for the remaining eight months, the year's sale abroad would reach the amazing total of $93,566,000. Although this figure is not expected to be achieved, a record volume of more than $60,000,000 is practically certain."

MR. DONNELLY REPORTS that Latin America has tripled its prewar imports and "continues to be our best export market." Of our total receiver exports last year, 84 per-cent were picked up by eleven markets—Brazil, Mexico, China, Cuba, Union of South Africa, Canada, Colombia, Venezuela, Chile, Argentine, the Philippines. . . . Only two clouds are on the current horizon, Mr. Donnelly believes. One is the falling off of dollar credit in many foreign countries. The other is the threat of competition. Toughest competitors to watch in the immediate future—England and Holland.

RADAR (airborne division) got a tremendous boost the other day when Navy ordered 100 sets for transport use. The contract is worth a million dollars. It was signed with the *Houston Corporation,* Los Angeles. Specs for the new radar were worked out by Army, Navy, and American Airlines. They have been more than a year in the making. The units are light—about 150 pounds—so that they will do no serious damage to a plane's pay load. They will be mounted in the plane's nose, giving the pilot a 220-degree view of what's ahead, or under the fuselage, giving a complete 360-degree radar "map." A five-inch scope will be mounted in both the pilot's and co-pilot's positions. Some of the sets will have 12-inch scopes in the radioman's compartment for navigating long water hops. The sets will pick up land a hundred miles ahead. When used with radar beacons, bearing and distances may be determined up to 225 miles. The *Houston* contract signed by the Navy is the first of its kind.

—30—

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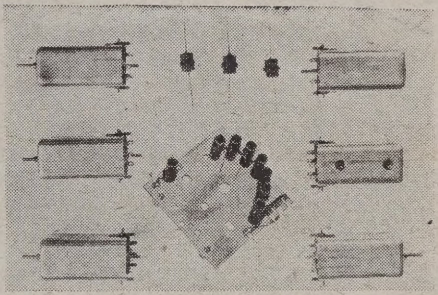

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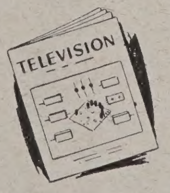

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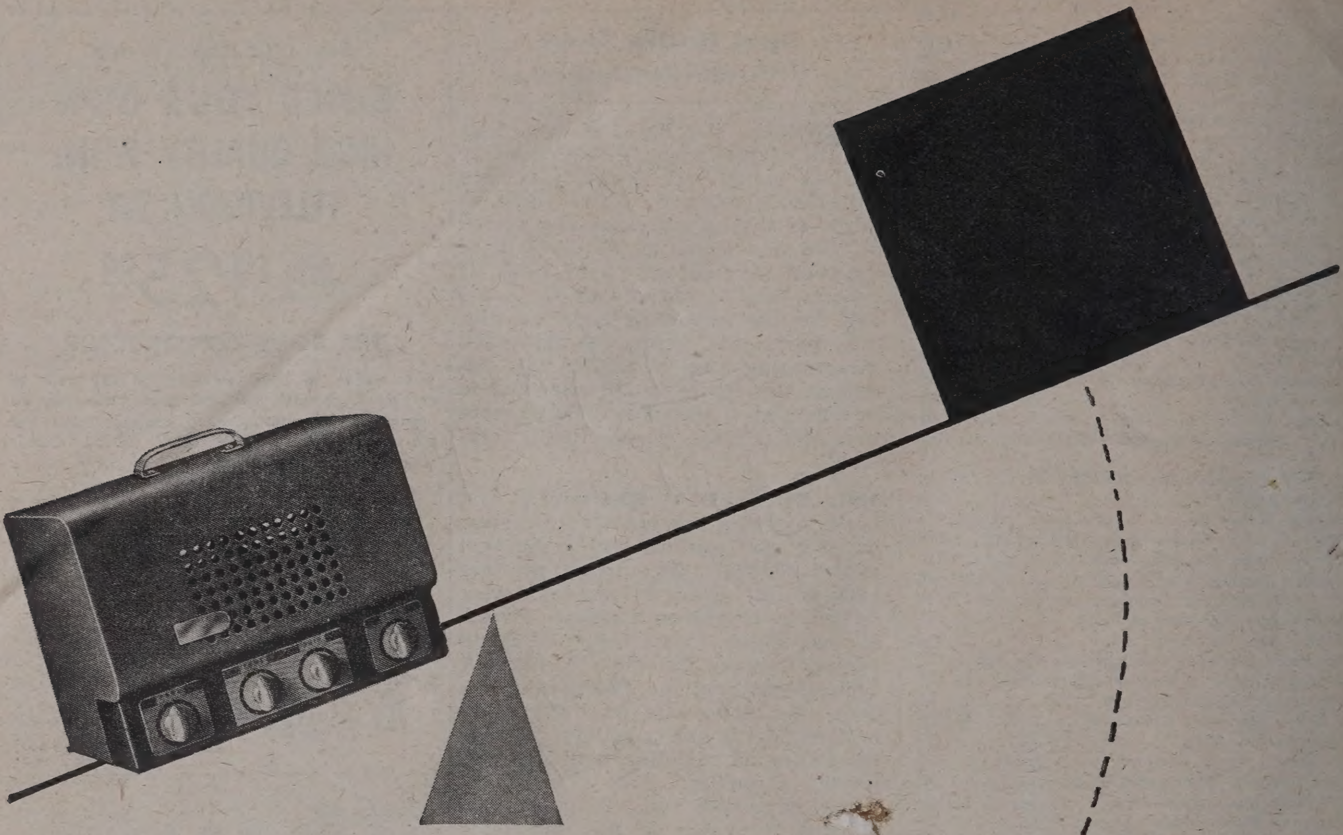

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